UNIVERSITY OF READING

Food fussiness in young children: The role of child temperament, feeding practices and sensory processing.

A thesis submitted for the degree of

Doctor of Philosophy

in the

Department of Psychology

School of Psychology and Clinical Language Sciences

University of Reading

Stella Rendall

May 2019

Declaration

I confirm that this is my own work and the use of materials from other sources has been properly and fully acknowledged.

Stella Rendall

Acknowledgements

I would like to thank my supervisors, Dr Kate Harvey and Dr Helen Dodd for the incredible support and guidance they have given me throughout my PhD journey. It has been a privilege to work under their mentorship as they have challenged me to think critically and equipped me with the necessary skills needed to become an independent researcher. I appreciate their patience and the time spent reading my drafts, editing and providing valuable feedback and I would always be grateful for their accessibility, encouragement and enthusiasm.

I also wish to thank all the mothers and children who participated in my studies. I am truly grateful for their time and cooperation and for inviting me into their homes to conduct part of my research.

Within the Department of Psychology, I would like to thank Dr Carien Van Reekum and Dr Rachel McCloy who acted as my monitors - thank you for the valuable advice. I would particularly like to thank Dr Teresa Tavassoli for sharing her knowledge and ideas and collaborating with me. I would also like to express my immense gratitude to Lauren Roach, Frankie Englezou and Zoe Ryan for assisting with data collection in my final study.

Finally, a warm and hearty thank you to my Mum, Dad and siblings. I am forever indebted to them for their endless love, continued support, belief in me and for empowering me to pursue my dreams.

ABSTRACT

Food fussiness is characterised by the rejection of familiar and novel foods, resulting in a diet that is inadequately varied and has negative implications for children's current and future health. Food fussiness negatively affects family relationships and parental stress. Given these negative consequences, a strong understanding of risk factors for food fussiness is important for prevention and the development of effective interventions. Previously identified correlates and predictors of food fussiness include child temperament, child sensory hyperreactivity, maternal psychopathology, maternal core beliefs and maternal use of controlling feeding practices. To date there is a lack of studies examining these factors together.

This thesis explored food fussiness in children aged 2-4 years. It comprised four studies:

1. Study 1 determined the relationship between child temperament, maternal psychopathology, maternal core beliefs and maternal self-esteem and food fussiness and found emotional child temperament to have the strongest association with food fussiness.
2. Study 2 validated maternal reported food fussiness against independently rated child food rejection and acceptance behaviours and found the food fussiness subscale of the Child Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson, and Rapoport, 2001) to be a valid measure of food fussiness.
3. Study 3 examined how emotional child temperament interacts with maternal feeding practices to explain food fussiness. Results showed that maternal use of verbal pressure and physical prompts moderated the relationship between emotional temperament and food fussiness.
4. Study 4 examined the relationship between food fussiness and both emotional temperament and sensory hyperreactivity. Results showed that sensory hyperreactivity in tactile, taste and olfactory sensory domains was positively associated with food fussiness. In addition, sensory hyperreactivity explained variance in food fussiness over and above emotional temperament.

The findings highlighted child and maternal correlates of food fussiness in young children. The thesis concluded with the recommendation that children's emotional temperament and sensory hyperreactivity, as well as mothers' feeding practices, should be considered in the development of interventions designed to prevent and address food fussiness.

Table of contents

List of figures

List of tables

Chapter 1: Literature Review

1.1 Definition of food fussiness

Children's food fussiness, also known as "choosy eating", "faddy eating", "picky eating", "selective eating", "irregular eating" and incorporated under the umbrella term "food refusal" (Dovey, Staples, Gibson, & Halford, 2008; Farrow & Coulthard, 2012; Mitchell, Farrow, Haycraft, & Meyer, 2013; Rydell, Dahl, & Sundelin, 1995) is frequently reported by parents as a challenge. McCormick and Markowitz (2013) described food fussiness as a common feeding difficulty at one end of a spectrum with severe feeding problems at the other end.

In some studies, the terms food fussiness and food neophobia have been used synonymously (e.g., Pelchat & Pliner, 1986; Pliner & Hobden, 1992), however, evidence suggests that they are behaviourally and theoretically distinct. Food neophobia has been defined as the rejection of foods that are novel to the child or an aversion to the taste of unfamiliar foods (Dovey et al., 2008; Pelchat & Pliner, 1995). Evolutionary researchers propose that food neophobia evolved as a survival mechanism that proved beneficial to mobile infants in prehistoric times when humans foraged for food (Rozin, 1986). Food neophobia may have protected infants by dissuading them from tasting foods with which they have had no prior experience (Dovey et al., 2008) thus reducing the likelihood of them ingesting potentially noxious foods (Martins & Pliner, 2005). In the modern environment, however, where harmful ingestibles are removed or labelled as unsafe and where infants' food is typically controlled by their caregivers, food neophobia can hinder children's acceptance of novel foods, including healthy foods such as fruits and vegetables (Pliner & Loewen, 1997).

By contrast, and unlike food neophobia, food fussiness is defined as the rejection of both familiar as well as unfamiliar food, making food neophobia a characteristic of food fussiness (Dovey et al., 2008). A range of diverse definitions are used to define food fussiness and there is no single widely accepted definition. Lumeng, Gannon, Appugliese, Cabral, and Zuckerman (2005) conceptualised food fussiness as an unwillingness to consume familiar foods or to try novel foods that is severe enough to interfere with daily routines to an extent that is problematic to the parent, child or parent-child relationship. Similarly, endorsing the avoidance of novel and familiar foods, Dovey et al. (2008) defined food fussiness as the consumption of an inadequate variety of foods through the rejection of foods that are both familiar and unfamiliar. In contrast, Mascola, Bryson, and Agras (2010) defined food fussiness as the restriction of food intake, particularly with the avoidance of fruits and vegetables and strong food preferences often resulting in parents providing the child with another meal. Hafstad, Abebe, Torgersen, and von Soest (2013) defined food fussiness as the consumption of an insufficient amount or inadequate variety of foods through rejection of food items. Finally, van der Horst, Eldridge, Deming, and Reidy (2014) conceptualised food fussiness using the following behaviours: limited number of food items in the diet, unwillingness to try new foods, limited consumption of vegetables and other food groups, strong food likes/ dislikes and the requirement of special preparation of food. More recently, it has been recommended that food fussiness should be given the clinical diagnosis of avoidant/restrictive food intake disorder (ARFID) if it is observed to impede physical and emotional development or wellbeing (Eddy, et al., 2015; Fisher, Rosen, Ornstein, Mammel, Katzman et al., 2014).

While these definitions include elements such as the rejection of both familiar and novel foods, restriction of food intake and the avoidance of fruits and vegetables which can be objectively measured, measuring the severity of food fussiness and its interference with daily routines in the definition provided by Lumeng et al. (2005) can be difficult to quantify and can't easily be observed during mealtimes. In addition, the element of "strong food preferences" in the definition provided by Mascola et al. (2010) is a little vague and difficult to operationalise as the qualities of the preferred foods are not specified. The definition provided by Hafstad et al. (2013) although measurable objectively is quite narrow as it fails to specify the type or quality of the food items that are being rejected by children. Finally, Van der Horst et al. (2014) conceptualisation of food fussiness is quite broad and also includes some vague description of behaviours, i.e. limited consumption of other food groups, such food groups are not specified. In addition, their definition includes elements that are not easily measured and observed during mealtimes e.g. special preparation of food.

For the purposes of the work in this thesis, the definition of food fussiness provided by Dovey et al. (2008) on p. 2 will be used, that is "consumption of an inadequate variety of foods through the rejection of both familiar and unfamiliar foods". This definition is chosen for the following reasons: it specifies the qualities of foods rejected by children i.e. novel and familiar foods, it can be operationalised with food rejection behaviours easily observed during mealtimes and can be measured both via a standardised questionnaire and objectively. This definition aligns with the concept of food fussiness as measured by the Food Fussiness (FF) subscale of the parent-report CEBQ (Wardle et al., 2001).

It should be noted that the terms "healthy" and "unhealthy" foods have been used throughout this thesis. Although it is acknowledged that these food labels are unscientific as many so called "healthy" foods sold in supermarkets have comparable amounts of salts, fats and sugars as "unhealthy" junk foods, the use of these terms in this thesis reflects their use in the literature.

1.2 Measurement of Food fussiness

Because no agreed operational definition exists for food fussiness, there is inconsistency in the methods used to measure it. These methods generally fall into two broad categories: the use of parent-report and the use of parent-report plus behavioural measures of food fussiness. These methods will now be discussed.

1.2.1 Parent Report

As children would be unreliable reporters of their eating behaviour, a significant proportion of research on fussy eating relies on parent report. Research has shown that parents are usually privy to and have the opportunity to observe their child's behaviour across numerous occasions and contexts. As such they can be deemed to be reliable sources of information about their child's eating behaviour

(Cooper, Whelan, Woolgar, Morrell, & Murray, 2004; Whelan & Cooper, 2000). A range of methods are used to capture information from parents regarding their child's fussy eating.

In some studies parents/caregivers are simply asked if they consider their child to be a fussy eater. Response options are typically "Yes", "No" or "Don't Know" (e.g., Carruth, Ziegler, Gordon, & Barr, 2004; Goh & Jacob, 2012). Others offer a range of responses for example from "never" through to "always" (e.g., Jacobi, Agras, Bryson, & Hammer, 2003; Jacobi, Schmitz, & Agras, 2008). Typically, in these studies parents are not provided with a definition or description of food fussiness but are allowed to use their own conceptualisation of food fussiness to categorize their child. While it could be argued that this method of determining food fussiness is meaningful to individual parents, it is difficult to compare across parents as their conceptualisation of food fussiness is unknown (Carruth et al., 2004). In addition, parents' perception of food fussiness tends to be interpreted in varying ways and may not reflect children's actual eating behaviour (Li et al., 2017). For instance, some parents could label their child as being a fussy eater because they fail to consume the amount and type of food perceived as appropriate while some parents could differ on the type, frequency and extent of behaviours deemed as reflective of food fussiness (Byrne, Jansen, & Daniels, 2016).

Other studies have used qualitative methods to assess parents' perceptions of food fussiness. For example, Boquin, Moskowitz, Donovan, and Lee(2014) used focus groups to assess parent's perception of food fussiness. Nineteen parents were divided into three groups of 6 or 7, each group consisted of a mix of parents who had described their children as fussy or non-fussy eaters (21 children described as fussy and 12 as non-fussy). Parents were asked by a moderator about their beliefs, attitudes and concerns about food fussiness. This method is an improvement on simply asking parents if they consider their child to be fussy as it attempts to explore parents' perceptions with the aim of identifying whether there are common behaviours that parents use to describe a fussy eater. Boquin and colleagues found that although parents had different perceptions of food fussiness, four common themes emerged from the focus groups: unwilling to try new foods, consuming a limited amount and variety of food, requiring special preparation and presentation of foods and actively avoiding mealtimes. These themes can be considered parent-relevant dimensions of the food fussiness concept. However, behavioural validation of parents' perception would be useful in determining whether these behaviours are typical presentations of food fussiness.

Some researchers have also determined fussy eater status based on specific criteria. For example, Chatoor, Surles, Ganiban, Beker, and Paez (2004) determined fussy eater status using two criteria: (1) the presence of a persistent refusal to consume all types of foods or certain types of food causing parental worry and (2) indication of faltering growth. Nicholls et al. (2001) proposed that food fussiness should be determined by five behavioural constraints: (1) child consumes a range of 10 foods or fewer (2) a normal range of foods for age has never been consumed by the child (3) persistence of food fussiness over the age of 7 (4) avoidance or rejection of new foods and (5) no physical illness sufficient to explain food avoidance. These conceptualisations rely on parents' perception for information on these behavioural criteria and have several un- operationalised subjective elements for example what constitutes "parental worry" (Chatoor et al., 2004); what is a "normal range" (Nicholls, Christie, Randall, & Lask, 2001).

Other researchers have used standardized questionnaires such as the Child Feeding Questionnaire (CFQ; Birch et al., 2001), Child Behaviour Checklist (BCL; Richman & Graham, 1971) and the CEBQ(Wardle et al., 2001) to classify a fussy eater (e.g., Galloway, Lee & Birch, 2003; Hafstad et al., 2013; Haycraft, Farrow, Meyer, Powell, & Blissett, 2011). These questionnaires were originally developed to investigate childhood obesity, behavioural problems and parent feeding practices with their use in assessing food fussiness a secondary objective (Mayeaux, Donovan, Lee, & Moskowitz, 2010). These questionnaires however have been shown to be valid and reliable in discriminating between fussy and non-fussy eaters identified through various criteria.

The CFQ was developed to assess parent's perceptions and concerns about childhood obesity, child feeding attitudes and parent feeding practices (Birch et al., 2001). The CFQ has seven subscales including the picky eating subscale which measures parents' perception of their child's willingness to eat foods. The validity and test-retest reliability of the CFQ has been established by several studies (e.g., Birch et al., 2001; Corsini, Danthiir, Kettler, & Wilson, 2008; Geng et al., 2009). The picky eating subscale of the CFQ has been shown to reliably identify fussy eaters based on their low consumption of vegetables and lower weight status in comparison to non-fussy eaters (Berger, Hohman, Marini, Savage, & Birch, 2016). Berger et al. (2016) however used 24- hour dietary recall and three-day food diary provided by mothers to obtain dietary intake of fussy and non-fussy eaters. There are no studies, however examining the correlations between scores on the picky eating subscale of the CFQ and observations of children's eating.

The BCL is a 19- item scale designed to investigate emotional and behavioural disturbance in pre-school children (Richman & Graham, 1971). It includes two eating related items; lack of appetite and food fussiness to assess food fussiness. The BCL has been shown to have good inter-rater reliability and internal consistency as well as good construct and concurrent validity (McGuire & Richman, 1986). However, there is lack of evidence on how well the items designed to assess food fussiness in the BCL fully capture food fussiness.

The CEBQ was developed to capture individual differences in a range of eating styles in children and consists of eight scales including a Food Fussiness (FF) subscale (Wardle et al., 2001). The psychometric properties of the CEBQ have been supported among several ethnically diverse samples (e.g., Carnell & Wardle, 2007; Domoff, Miller, Kaciroti, & Lumeng, 2015; Mallan et al., 2013; Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009). The CEBQ has been found to have high test-retest reliability (Mallan et al., 2013; Sleddens, Kremers, & Thijs, 2008) and good internal validity (Carnell & Wardle, 2007; Svensson et al., 2011). The FF scale has been validated as an accurate measure of food fussiness by comparisons to a "gold standard" psychiatric interview. Steinsbekk, Hamre Sveen, Fildes, Llewellyn, and Wichstrøm (2017) examined the FF scale's screening efficacy using the Preschool Age Psychiatric Interview (PAPA) in a sample of Norwegian children. The PAPA is a semi-structured psychiatric interview administered to parents which asks about their child's food preferences, appetite, restricted consumption of food and resulting impaired functioning. Using the PAPA, children are categorised into no food fussiness, moderate food fussiness or severe food fussiness. Steinbekk et al. (2017) found the FF scale of the CEBQ to be efficient at discriminating between 6-year-old PAPA defined fussy and PAPA defined non-fussy eaters. Similarly, Rogers, Ramsey, and Blissett (2018) examined the relationship between the subscales of the CEBQ and the single feeding problem score yielded by the Montreal Children's Hospital Feeding Scale (MCHFS; Ramsay, Martel, Porporino & Zygmuntowicz, 2011). The MCHFS is a brief, 14 item parent-report measure of children's feeding problems including poor appetite, experience of gastrointestinal illness, neophobia, sensory processing and poor oral motor or feeding skills (Ramsay et al., 2011). The MCHFS generates a single score (higher scores reflect greater feeding problems) and has been used to identify feeding problems in children from 6 months to 6 years of age as well as their prevalence in various cultures (Ramsay et al., 2011). Rogers et al. (2018) found the FF scale of the CEBQ to be significantly positively related to the MCHFS, with greater food fussiness associated with higher MCHFS scores. This finding suggests that the FF scale demonstrates relationships with other parent-report measures of children's feeding problems, an indication of good criterion validity.

Scores on the FF subscale of the CEBQ have also been validated against observations of children eating behaviour with the finding that having a higher score on the FF subscale correlated with greater crying refusals during an observed mealtime (Fries, Martin, & van der Horst, 2017).

Across all these questionnaires, parents are asked about the extent to which they perceive their child's food fussiness or the extent to which their child engages in behaviours judged by researchers to be indicative of food fussiness. For example, the BCL (Richman & Graham, 1971) examines parents report of how they perceive their child's food fussiness using three response options ranging from 1 ("not fussy about eating") to 3 ("very fussy, doesn't like many different foods").The FF subscale of the

CEBQ (Wardle et al., 2001) asks parents to indicate on a 5 point Likert scale ("never" to "always") how typically specific eating-related behaviours occur such as "my child refuses new foods". The picky eating subscale of the CFQ (Birch et al., 2001) also uses a 5-point Likert scale ("disagree" to "agree") to examine parent's perception of their child's willingness to eat during mealtimes. For all three scales, mean scores are calculated from responses, with higher scores indicating greater food fussiness. The use of standardized questionnaires builds on research that asks parents if they consider their child to be fussy. A strength of these measures is that they break down food fussiness into specific behaviours rather than relying on parents' idiosyncratic definitions of fussy eating. This ensures consistency across parents which support research into the causes and correlates of fussy eating. Strengths of the use of parent-report questionnaires include their cost effectiveness, convenience and the ease with which they can be administered to a large and diverse group of people. However, the reliance on parent self-report measures to inform on child eating behaviours can be criticized for being a subjective, second hand interpretation of the child's eating behaviour with parents being more likely to provide responses deemed as socially desirable (Carnell & Wardle, 2007). There is also the issue of biased responses in parent self-reports i.e. parents that are overly concerned about their child's food fussiness may be more inclined to overestimate food fussiness behaviour in their children in such reports (e.g., Boquin, Moskowitz, Donovan & Lee, 2014). Parents have also been found to provide fluctuating responses to the same question enquiring about their child's eating behaviour leaving the reliability of parent-report in doubt. For example, Boquin, Smith-Simpson, Donovan, andLee(2014) asked parents of children aged 2-4 years to respond with either a "yes" or "no" to the following question "is your child a fussy eater?" on five different occasions during a two-week period and found that parents provided inconsistent answers.

1.2.2 Parent-report plus behavioural measures

Because of the limitations associated with the reliance on parents' perception of food fussiness and the subjective nature of parent-report, some studies have determined food fussiness status by including objective measures of child eating behaviour in addition to parent-report. Methods aimed at obtaining objective measures of food fussiness have included the use of food records/diaries, food frequency questionnaires, measuring average food intake and behaviour observation. A few researchers have also used 24-hour food recalls to measure food fussiness which requires mothers to recall from memory everything the child ate during the previous day. 24-hour food recalls, however, can be criticised as being reliant on parents' memory which is open to recall bias, a systematic error whereby individuals fail to remember previous events accurately or omit details (Mahtani, Spencer, Brassey, & Heneghan, 2018). In addition to the use of parent report, Carruth, Skinner, Houck, Moran, Coletta, and Ott (1998) calculated the dietary variety scores and food intake of children aged 24-36 months. Mothers were given a modified questionnaire developed by Pelchat and Pliner (1986) comprising 20 behaviour-type questions, e.g. "How often does your child eat new and unfamiliar foods when offered"? Responses were scored on a 7-point scale ranging from "never" to "almost always" to reflect the degree the child displayed a particular behaviour. This provided one measure of whether the mother considered her child to be a fussy eater. Mothers were then asked to complete two-day food diaries where a record of the child's intake is documented as well as a 24-hour recall of the child's food intake. Combining data from each source, Carruth et al. (1998) found fussy eaters to limit their intake of fruits and vegetables and have a preference for certain food groups. This method has also been replicated with parents of children aged 4-5 years (Jacobi et al., 2003) and 7 year olds (Galloway et al., 2003) and both have found fussy eaters to consume small portions of food, avoid fruits and vegetables, have lower dietary variety, reject new foods and have strong food preferences. Although this method uses two data sources to determine food fussiness status, both sources are still reliant on parents' perception. In addition, like 24-hour food recall, the use of food diaries also relies on parent's memory and parent perceptions are likely to affect under and over-reporting of food intake. Further, the days selected to document food intake in food diaries may be unrepresentative of the child's usual food intake (Willett, 2001).

To assess the food intake and dietary variety of children aged 4-5 years, Jacobi et al. (2003) used an observational approach, providing individual children with a buffet comprising a variety of foods totalling approximately 5000 kcal. Caloric intake was calculated by weighing each food item in the buffet before and after the meal. Foods were classified into the following food categories: dairy, fruits, vegetables, breads and grains, meats and other proteins, sweets and condiments. Indicators were created to identify children who had not eaten foods of a particular category. However, because most children consumed foods in the dairy, breads, grains and condiments categories, variety was determined by the consumption of foods in the fruits, vegetables and sweets categories. Fussy eaters were observed to have limited dietary variety and to consume an inadequate amount of food. Fussy eaters were more likely to avoid eating vegetables, ate on average one food less and decreased their caloric intake by more than 200 calories in comparison to non-fussy eaters. While this method ensured food choice so that dietary variety could be determined, it is not typical of a usual meal and it is not clear whether children were being fussy in rejecting some food groups or whether they were satiated from over-indulging in their favourite food(s). In addition, the study assessed food fussiness in an Infant Feeding Laboratory in a University. While this method was likely to ensure tight control of any extraneous variables, the artificial environment may also have elicited "unnatural" behaviours from the child.

Similarly, Werthmann et al. (2015) also used an observational approach in addition to parent report to assess food fussiness. Parents of children aged 30-48 months were asked to complete the Food Fussiness subscale of the CEBQ (Wardle et al., 2001). Children were offered variants of a well-known yoghurt, with texture, taste, colour manipulated. Food acceptance was measured via the amount consumed. Fussy eaters were found to reject specific food textures, consuming less of the yoghurt that contained raspberry pieces, preferring instead the smooth variant. The colour and taste of the yoghurt did not have an effect on children's consumption. Werthmann et al. (2015) assessed food fussiness in a special room in a day care centre. A large majority of preschool children with employed parents currently spend a significant amount of time each week in day-care centres. In the UK, young children aged 2-4 years spend an average of 25 hours in day-care each week, therefore day-care settings may be considered naturalistic for these children given that a significant amount of time is spent there. The group setting and the presence of other children in day-care centres has the advantage of fostering the development of social and cognitive skills (Vemeer & Van IJzendoorn, 2006) as well as an opportunity for peer modelling in relation to food acceptance (e.g., Greenhalgh et al., 2009). Day-care settings, however, have been found to produce elevated stress levels in children as peer groups are a demanding context for young children that involves frequent emotional arousal (Vemeer & Van IJzendoorn, 2006). Given this, it is plausible that research observing children eat in day-care settings may trigger stress responses associated with this environment which may influence their eating behaviour. While young children are used to having their meals at day-care, research observing children in more naturalistic environments such as their homes (where peer-group associated stress is absent), consuming a typical meal would be a better method that allows researchers to observe how children usually eat and to determine food fussiness status. Doing so would enable parent-reported food fussiness obtained from standardized questionnaires to be compared to children's usual mealtime behaviours. More recently, Fernandezet al. (2018) also investigated whether scores on the food fussiness subscale of the CEBQ correlated with observations of children's food fussiness. In this study, mothers and their children's responses to familiar and unfamiliar foods were observed in a laboratory Structural Eating Protocol (SEP). The SEP examined mother's and child's responses to different foods and aimed to reduce the variability that may occur with home meals such as quantity and type of food served, television distractions and other family members. Mothers and children were videotaped while presented with similar portion sizes of four vegetables which were green beans and peas (familiar vegetables) and artichoke and palm cabbage (unfamiliar vegetables). Mothers also completed the FF scale of the CEBQ to measure their children's food fussiness. The amount of vegetable consumed by the child was determined by subtracting the post-weight of the food from the pre-weight of the food. Children's hedonic rating of each vegetable was also obtained by the researcher who presented children with a scale of five faces ranging from 1 (really yucky) to 5 (really yummy). Finally, maternal encouragement and child compliance with maternal encouragement were also coded. Fernandez et al. (2018) found that maternal-reported food fussiness was associated with observed child fussy eating behaviours in the laboratory protocol. It was found that greater maternal reported food fussiness related to fewer grams of unfamiliar and unfamiliar foods consumed, lower hedonic ratings and less compliance with maternal encouragement. It should be noted that in this study, Fernandez et al. (2018) only provided children with four vegetables limiting the opportunity to observe children's responses to the presentation of other food groups. In addition, like previous studies, mealtime observation was conducted in a laboratory which may have influenced children's eating behaviours and may not reflect the child's typical eating behaviours. Observing children's eating behaviours in other environments such as the home may elicit typical eating behaviours.

A few studies have investigated children's mealtime behaviours in the home environment. Boquin, Smith-Simpson, Donovan and Lee (2014) asked parents of children aged 24-48 months whether they considered their child to be a fussy eater asking the question, "is your child a fussy eater?" with responses ranging from "Never" to "Always" as used in some studies (e.g., Jacobi et al., 2003, 2008). Parents were then given 12 food items comprising of familiar and unfamiliar foods which were selected for being appropriate for 2-4-year olds to consume. Parents were also given a folder with instructions on how foods items should be prepared to create novelty. For example, there were two egg preparations (hard or scrambled), three chicken preparations (deli, grilled or breaded) and three pasta preparations (pasta without sauce, pasta with tomato sauce and pasta with Alfredo sauce). A standardized meal created from variants of the food items was then given to children in a home use test (HUT). The child's estimated intake and overall liking of the presented meals were evaluated by their parents after the meal. To measure food intake, parents estimated the percentage of food consumed by their child relative to the food served. To assess overall liking of the meal, parents asked their children whether they liked the meal with response options of "Yes", "No" or "Don't know". Parents were also asked to report on their children's mealtime behaviours and acceptance of presented food items. Children perceived by their parents as fussy eaters were reported by parents to have an excessively lengthened feeding time, seem sad about the food served, rejected familiar and unfamiliar foods, gagged when trying food items and were more likely to request a different food to that offered. Asking parents to evaluate children's responses in real-time from immediate experience is an improvement on methods used in previous research that have relied on parent's memory recall. In addition, presenting children with a meal in a more naturalistic environment is an improvement on laboratory-based studies and more likely to elicit natural responses. However, the fact that parents evaluated their child's mealtime behaviours means that reports were still likely affected by parent's perceptions of their child's food fussiness. This is, particularly likely for behaviours based on subjective judgements such as "seems sad or disappointed with presented meal" (Fries et al., 2017). Evaluation of children's behaviours during mealtimes by an independent researcher rather than parents would be a better method of capturing children's fussy eating independent of parents' perception (Fries et al., 2017).

A home observation of fussy eating was included in recent research by Fries et al. (2017). In this study, food fussiness was measured via parent report and behavioural observation in the home environment. However, unlike Boquin, Smith-Simpson, Donovan and Lee (2014) children's mealtime behaviours were video recorded and objectively evaluated by trained researchers. Parents of children aged 12 -36 months completed the food fussiness subscale of the CEBQ. Parents were then provided with video cameras to record their children's eating behaviours over the course of two days. On day one, parents recorded their children's eating behaviour in response to the presentation of familiar foods while children's response to the presentation of a novel fruit/ vegetable was recorded on day two. Videos were coded by trained researchers for children's food refusals and included behaviours such as pushing food away, crying, spitting food out, ignoring the food offered and verbal refusals. Fries et al. (2017) found that although parent reported food fussiness was not associated with overall food refusals (spitting, pushing food away, crying, verbal refusal, closing/covering mouth and ignoring offered food), when broken down into type of refusal, parent reported food fussiness was associated with greater crying refusals. In this study however, the authors acknowledged the possibility that parents of fussy eaters may have chosen to give their children foods that they were more likely to accept which may explain why fussy eaters displayed fewer food refusals during the observed mealtime. This was supported by the finding that children of parents who were likely to serve them with an alternative meal made more food refusals when presented with a novel food. Research where children's foods are chosen independent of parents would be a better method of investigating and observing mealtime behaviours associated with food fussiness.

To summarise, across the literature, there is diversity in the way in which food fussiness has been defined and measured. This is problematic when trying to draw broad conclusions from the literature, for example when trying to estimate the prevalence of food fussiness.

1.3 Prevalence, Stability and Incidence of Food fussiness

1.3.1 Prevalence

Research investigating the prevalence of food fussiness in children has reported varying estimates, depending on the age of the child. In the 2002 US Feeding Infants and Toddler Study (FITS) study of 3000 children aged four months to 24 months, Carruth et al. (2004) conducted a cross-sectional survey to determine the prevalence of parents who perceived their children to be fussy eaters. Carruth et al. (2004) found that as children get older, parents have an increased perception of their child's food fussiness, with a reported prevalence of 25% at 7-8 months increasing to 35% at 12-14 months and increasing further to 50% at 19-24 months. In Norway, Hafstad et al. (2013) found that mothers' perception of their children's food fussiness increased from 22% at 18 months to 35% at 2.5 years and to 40% at 4.5 years. Although the trend of parents' perception of children's food fussiness increasing with the child's age is consistent in both studies, there is a notable difference in the actual prevalence estimates i.e. 35% vs 50% at aged two years. This difference could be attributed to the different methods of measuring food fussiness in each study. Carruth et al. (2004) asked caregivers whether they considered their child to be a fussy eater without defining the term, leaving it open to caregivers' interpretation. Hafstad et al. (2013) on the other hand assessed food fussiness using two eating related items; lack of appetite and food fussiness of the Behaviour Checklist (Richman & Graham, 1971).

A decline in the prevalence of food fussiness in middle childhood has been observed in a few studies. For example, in the Netherlands, Cardona Cano et al.(2015) investigated the trajectory of food fussiness during childhood by assessing children using maternal report at three time points: 1.5 years, 3 years and 6 years. They reported prevalence rates of 26.5% at 1.5 years, 27.6% at 3 years declining to 13.2% at 6 years suggesting that food fussiness tends to increase in early childhood but later begins to decline as the child gets older. A similar finding was observed in Denmark where parents reported a low prevalence of 7.3% in children aged 5-7 years (Micali, Simonoff, Elberling, et al., 2011).

Studies aimed at determining the prevalence estimates of food fussiness have reported statistics that seem to indicate that food fussiness is a transient eating behaviour problem. These studies seem to show that mothers have an increased perception of food fussiness in early childhood up to age 5 but the perception decreases as the child gets older. A plausible alternative explanation for the decline in parental perception of food fussiness with increasing child age is that it is possible that with time parents feed their children foods that they like and no longer perceive and report food fussiness as a problem, research exploring this possibility is warranted. However inconsistent findings were found in a recent cross-sectional study investigating the prevalence of food fussiness in older children. In this study, Jacobi et al. (2008) reported that mothers of children aged 8-12 years perceived 19% of girls and 18% of boys as fussy eaters, a similar prevalence rate to that reported in early childhood.

Research investigating the prevalence of food fussiness has produced discrepant results possibly due to the lack of a homogenous measurement of food fussiness.

It is likely that different methods of measuring food fussiness yield different responses from parents. This is evident in a study in which parents were merely asked if they considered their child to be fussy and later provided with a list of “fussy” behaviours to guide their responses. Goh and Jacob, (2012) asked parents of children aged 1-10 years “Do you think your child is a fussy eater?” which resulted in parent reported prevalence of 24-25%. However, in the same study parents were then provided with a list of typical behaviours of fussy eaters such as refusing food and limiting fruit and vegetable intake, parent reported prevalence subsequently increased to 49.6%. Until there is a “gold standard” for determining fussy eater status to be used across studies, prevalence estimates are likely to vary.

1.3.2 Stability

Alongside studies of prevalence, a few studies have examined the stability of food fussiness within individuals across early childhood using longitudinal designs. In the US, Jacobi et al. (2003) investigated the stability of food fussiness at different times in the child’s life. Food fussiness was measured in 135 children at two time points; which was when the children were aged 4 years and 5 years. At both times, mothers were asked to respond on a 5-point Likert scale (never, rarely, sometimes, often and always) if they perceived their child to be a fussy eater. Jacobi et al. (2003) stipulated that to be classified as a fussy eater, a response of at least “sometimes” had to be given at both time points and a response of at least “often” had to be given for either age 4 or 5. Parent reported food fussiness at ages 4 and 5 was found to be significantly positively correlated suggesting stability in parental perception of food fussiness across these two time points. A similar finding was obtained by Dubois, Farmer, Girard, and Peterson (2007) who measured food fussiness in children over three years when they were 2.5, 3.5 and 4.5 years. In this study, food fussiness was measured using a maternal 24-hour recall of type and quantity of foods the child consumed as well as the child’s meal patterns. Dubois et al. (2007) found the dietary pattern of fussy eaters to be the same at each time point, fussy eaters consumed fewer servings of vegetables at all ages from 2.5 to 4.5 years of age. It is important to note that a few studies have found food fussiness persists into late childhood and pre-adolescent years. There have been reports of the stability of food fussiness from childhood into adolescence and adulthood. For example, in a longitudinal study, Nicklaus, Boggio, Chabanet, andIssanchou (2005) found the dietary pattern of fussy eaters aged 2-3 years to be the same from 4 years of age up to age 22 years. Nicklaus et al. (2005) provided children aged 2- 3 years with food items from several food groups and allowed free choice during a nursery lunchtime. A food variety seeking score was calculated for each child by dividing the number of different foods the child had chosen by the total number of foods offered multiplied by 100. A follow up was conducted at four time points; 4-7 years, 8-12 years, 13-16 years and 17-22 years where food variety was assessed using a questionnaire. Nicklaus et al. (2005) found food variety seeking at age 2-3 to be significantly related to food variety seeking at all follow ups. Similarly, parent reports of food fussiness have been found to be significantly correlated over time in children aged 4 – 11 years (Ashcroft, Semmler, Carnell, van Jaarsveld, & Wardle, 2008). McDermott et al. (2010) also found that 40% of children perceived as being fussy eaters by their mothers at age 5 were still perceived to be fussy eaters at 14 years of age. These findings suggest that for some children, food fussiness may not be a transient phase that remits in early childhood but may be a stable trait that persists throughout childhood.

1.3.3 Incidence

To date, only one study has investigated the incidence of food fussiness. Incidence has been described as the number of new cases of a behaviour in a population over a specified period and differs from prevalence and stability which are the proportion of individuals affected by the behaviour at any given point in time and the continuity of the behaviour over time respectively (Smink, van Hoeken, & Hoek, 2012). Using a longitudinal design, Mascola et al. (2010) investigated the incidence and persistence of food fussiness from 2 to 11 years of age. To measure food fussiness, parents were asked if they considered their child to be a fussy eater as well as to complete a

24-hour dietary recall which showed the expected differences in the food intake between fussy and non-fussy eaters i.e. fussy eaters consumed fewer foods and had lower caloric intake in comparison to non-fussy eaters. These assessments were carried out yearly when the child was between 2 and 7 years and then at 9.5 and 10 years respectively. Incidence was defined as new cases of food fussiness that were not reported in previous assessments. Mascola et al. (2010) found the incidence of food fussiness to be higher in early childhood (before 4 years of age) but falling to lower levels as the child gets older. They reported that the incidence at age 2 was 13% falling to 3% at age 6 and reducing further to 2% at age 11. It was also observed that although food fussiness first emerges in early childhood, the majority of the cases are of short duration (lasting for 1-2 years), recovering over a 2-year period. However, there was a subset of children for which food fussiness persisted with a longer duration of more than 3 years. These subsets of children were less likely to accept new foods in comparison to children with short duration food fussiness. In addition, parents of these children reported more incidents of mealtime struggles over food than parents of children with short duration food fussiness. On the other hand, Mascola et al. (2010) found that unlike the incidence of food fussiness, which is highest in early childhood, the prevalence of food fussiness was found to increase from 13% at age two to 22% at age 11 supporting some previous findings e.g. (Carruth et al., 2004; Hafstad et al., 2013) but contradicting others (Cardona-Cano et al., 2015). As noted earlier, varying prevalence estimates can be attributed to differential methods used to measure food fussiness which may explain the contradicting prevalence patterns reported by Mascola et al. (2010) who asked parents if they considered their child to be a fussy eater and Cardona-Cano et al. (2015) who used two eating related items on the BCL (Richman & Graham, 1971) to measure food fussiness.

1.4 Food Fussiness and Gender

Research investigating whether there is a prominent gender difference in food fussiness has produced mixed results. Some studies reveal no consistent gender differences. For example, Jacobi et al. (2003) did not find any gender differences in a group of perceived fussy eaters aged 4-5 years. Similarly, in the 2002 FITS US study of children aged four months to 24 months, Carruth et al. (2004) reported no significant difference in the gender of parent-perceived fussy eaters across all age groups examined. Other studies, however, have reported that a higher proportion of girls tend to be perceived as fussy eaters by their parents. For example, Brandon, (1970) in his study of childhood morbidity in children from birth to age 12 found that at age 12, girls were perceived by their parents as being fussier than boys. This finding could be attributed to pre-adolescence; an age associated with more weight concerns in girls over pressure to achieve a socially desirable physique (Lam & McHale, 2012; May, Kim, McHale, & Crouter, 2006). It may be that a higher proportion of girls at this age were more selective than boys during mealtimes in an attempt to control their weight resulting in girls being perceived as fussier. Marchi andCohen(1990), however, in their study of children aged 1 to 10 years through to ages 9-18 years found that parents perceived girls as being significantly fussier across all age groups, an indication that pre-adolescence and weight concerns may not fully explain gender differences in food fussiness. It is possible that the discrepant results found between studies investigating the association between gender and food fussiness may be due to methodological differences. Cross sectional studies which examine behaviour at one time point but provide no information about the behaviour over time did not find any gender differences in a group of fussy eaters e.g. (Carruth et al., 2004; Jacobi et al., 2003). Prospective studies which track behaviour over time found that girls were perceived as being fussier (Brandon, 1970; Marchi & Cohen, 1990).

1.5 Reasons for Food Fussiness

1.5.1 The Role of Innate Food Preferences

Food preferences in humans have been found to be genetically determined with behavioural predispositions to basic tastes (Birch, 1999; Mennella & Beauchamp, 1991; Rozin & Vollmecke, 1986; Steiner, 1979). Humans are born with an innate preference for sweet tastes and an aversion to bitter tastes (Galindo, Schneider, Stähler, Töle, & Meyerhof, 2012). An examination of the gusto-facial expressions of new-borns in response to exposure to sweet, salty, sour and bitter solutions revealed that new-borns exhibit positive hedonic responses to sweet tastes and negative reactions to sour and bitter tastes (Barr et al., 1999; Rosenstein & Oster, 1988). It has been proposed that the early preference for sweet and salty, and aversions towards bitter and sour tastes is biologically determined to ensure the consumption of edible foods and avoidance of harmful foods (Birch, 1999; Brug, Tak, te Velde, Bere, & De Bourdeaudhuij, 2008). This innate aversion to bitter tastes may explain why infants reject some bitter tasting fruits and vegetables such as grapefruits, broccoli, cabbage and brussel sprouts. These foods contain certain phytochemicals, such as polyphenols, flavonoids and glucosinolates which, although beneficial, intensifies their bitterness (Drewnowski, Henderson, & Barratt-Fornell, 2001). Innate preferences for sweet tastes have been found to influence food choices. For example, Wardle, Guthrie, Sanderson, Birch, andPlomin (2001) found that sweet tasting foods such as cakes, pies, cream, custard and desserts were among the top favourite foods of 4-5-year olds in the UK while vegetables were their least liked foods. Similar findings were obtained in the US amongst 2-8-year-old children (Skinner, Carruth, Bounds, & Ziegler, 2002).

Alongside an innate preference for sweet and salty flavours, other research demonstrates that children are born with an innate liking for energy dense foods. When presented with a choice of foods with high and low energy values, children have been found to prefer high energy dense fruits and vegetables such as bananas, potatoes and peas to lower energy dense options such as citrus fruits and spinach (Gibson & Wardle, 2003). Although, it can be argued that variation in sweetness (i.e. banana vs spinach) and not necessarily energy density influenced children’s preferences, Gibson and Wardle (2003) controlled for total sugar content and found that energy density remained a significant predictor of children’s preferences. This innate predisposition towards energy dense foods is generally assumed to be an adaptive mechanism, formed to promote the uptake of high calorific foods in environments depleted of food resources (Birch, 1998). Predisposition for energy dense foods is also likely to hinder the consumption of many fruits and vegetables with low energy densities

(Gibson & Wardle, 2003) and encourage the intake of high energy foods in place of healthier energy dense foods (Birch, 1998).

1.5.2 The Role of Learned Food Preferences

Food preferences in infants have also been found to be influenced by experiential factors, namely breastfeeding and weaning.

1.5.2.1 Breastfeeding

Breastfeeding is often described as the "gold standard" of infant feeding. It is recommended by the World Health Organisation as the infant's exclusive diet for the first six months of life (WHO, 2016). A recognised benefit of breastfeeding is the opportunity it provides for learning flavours. Flavours in the mother's diet such as vanilla, garlic or cumin are usually retained in her breastmilk, exposing the infant to a variety of flavours through the breastmilk (Mennella, Forestell, Morgan, & Beauchamp, 2009; Savage, Fisher, & Birch, 2008). This contrasts with formula milk which has a consistent flavour (Savage et al., 2008). Exposure to flavours through breastmilk has been found to influence acceptance for such flavours when children are weaned. For example, Mennella, Jagnow, andBeauchamp (2001) assigned pregnant women who intended to breastfeed to one of three groups: group one drank carrot juice in their last trimester of pregnancy and water only while breastfeeding, group two drank water while pregnant and carrot juice while breastfeeding and group three drank water while pregnant and breastfeeding. It was found that infants of mothers in groups one and two showed fewer negative responses when offered a carrot flavoured cereal during weaning in comparison to infants born to mothers in group 3. Exposure to a variety of flavours through breastmilk has also been shown to facilitate the acceptance of novel flavours. For example, Hausner, Nicklaus, Issanchou, Mølgaard, and Møller (2010) found that breastfed infants were more likely to accept a caraway-flavoured food in comparison to formula fed infants irrespective of whether they were exposed to caraway flavour through the mother's breastmilk or not. Previous research found breastfed infants are less fussy and more willing to accept a novel vegetable. For example, Galloway et al. (2003) asked mothers of 7-year-old girls to complete the “pickiness” subscale of the Child Feeding Questionnaire (Birch et al., 2001). Mothers were also asked if they breastfed their children and if yes, how many months they were breastfed for. It was found that girls were more likely to be fussy if they were breastfed for fewer than 6 months. Similarly, Shim, Kim, and Mathai (2011) found that children who had been breastfed exclusively during the first 6 months were less likely to be fussy. Both studies, however controlled for the confounding influence of sociodemographic characteristics such as education level and household income given that families with higher socioeconomic status are more likely to breastfeed and to offer a range of healthy foods whilst weaning.

1.5.2.2 Weaning

Weaning, now mostly known as complementary feeding is the progression of infants from a diet that is entirely milk-based to one primarily based on a variety of solid foods (Coulthard, Harris, & Emmett, 2009). It refers to the introduction of solid foods and the texture of those foods. Typically, solid foods are initially pureed with a gradual progression to lumpy foods that require chewing and a final endpoint where the child is given solid food in its conventional state (Coulthard et al., 2009). However, baby led weaning approaches where babies are offered a selection of age appropriate finger foods rather than pureed foods are becoming increasingly popular. The World Health Organisation recommends that in addition to breastmilk, infants should be introduced to lumpy solid foods between 6 months to 9 months and then to conventional food by the age of one year (WHO, 2016).

The weaning period has been found to be critical in determining children’s preference for tastes and textures and is a good predictor of dietary variety (Blissett & Fogel, 2013). Infants exposed to a wide range of tastes during the weaning period consume of a greater variety of fruits and vegetables in childhood (Cooke et al., 2004; Gerrish & Mennella, 2001; Skinner, Carruth, Bounds, Ziegler, & Reidy, 2002). In contrast, infants introduced to solids later than this critical period, in particular those introduced to solids later than 9 months have been found to be more fussy, to eat fewer fruits and vegetables and to have a more restricted diet at 15 months and at age seven (Coulthard et al., 2009; Northstone, Emmett, & Nethersole, 2001). During the early weaning period, children need as little as a single exposure to novel to foods to develop preferences for various tastes and textures (Birch, Gunder, Grimm-Thomas, & Laing, 1998; Coulthard & Blissett, 2009). However, in later childhood, research with children aged 2-5 years have found that as many as ten exposures are required to acquire food preferences (Birch & Marlin, 1982).

1.5.3 The Role of Child Development

There is also a developmental explanation for food fussiness in childhood. In the first year of life, breast- or formula milk is the main component of a child's diet with the introduction of solids during the weaning stage. By the second year, there is a physiological need for more nutrients to support adequate growth and sustain the child's increasing activity levels. It is at this stage that the majority of children's calorie intake starts to come from solid foods. Between the ages of 18 months and two years, parents report changes in their child's food preferences as children who were previously "good eaters" start to refuse familiar food items and to reject novel foods (Johnson, 2002). Studies of child development demonstrate this coincides with children beginning to strive for independence and autonomy and showing the first signs of oppositional behaviour (Satter, 1990). Researchers propose that some children express these desires for control and independence by articulating their food likes or dislikes, refusing previously liked foods, rejecting unfamiliar foods and being selective of foods based on their textures and tastes (Cathey & Gaylord, 2004; Dovey et al., 2008). In the US, Reau, Senturia, Lebailly, and Christoffel (1996) examined eating behaviour in 151 two year old children and found that between one fifth and half of the children displayed difficult mealtime behaviours such as refusing specific foods, trying to end meals after a few bites, food fussiness and strong food preferences. These developmentally linked behaviour changes can result in struggles between the parent and child during mealtimes, and lead parents to label their child a fussy (Cathey & Gaylord, 2004; Wright, Parkinson, Shipton, & Drewett, 2007). As children get older, from around age four, their cognitive skills develop along with an increased understanding of social settings and social cues from the environment which provide them with the opportunity to learn about food and eating (Johnson, 2002). These changes generally result in increased food acceptance and consequently fewer power struggles as children get older, which is indicative of a developmental phase that resolves with child maturity (Cathey & Gaylord, 2004).

1.5.4 Summary

Food fussiness has been described as the rejection of both familiar and novel foods resulting in the consumption of an inadequate variety of foods. There are several factors that may account for the dietary pattern observed in fussy eaters. An innate aversion for bitter tasting foods and an innate preference for sweet tasting and energy dense foods may explain why fussy eaters reject bitter tasting fruits and vegetables while cakes and desserts are examples of their most liked foods. Food fussiness has also been shown to be associated with a shorter duration of breastfeeding and the late introduction of complementary textured foods. Further food fussiness has been viewed as a developmental phase for toddlers where they begin to assert their autonomy within the parent-child relationship. Methods of measuring food fussiness are varied and include asking parents if they consider their child to be a fussy eater, the use of standardized parent-report questionnaires, the use of objective measures such as 24-hour recalls, food diaries and the food frequency questionnaire to determine average food intake and dietary variety as well as independent observations of the child's mealtime behaviour. Food fussiness is common in early childhood with prevalence estimates ranging from 26.5% (Cardona-Cano et al., 2015) to 50% (Carruth et al., 2004) in children's second year increasing to around 27.6% (Cardona-Cano et al.,2015) to 35% (Hafstad et al., 2013) at age three and declining to 13.2% at age six. Disparate methods of measurement between studies have been provided as a reason why there are varying estimates of prevalence. This was evident in a study that found different parent perceived prevalence estimates as a result of the use of different food fussiness assessment methods (Goh & Jacob, 2012). Further research using similar measures of food fussiness are required to provide consistent prevalence estimates between studies. Research investigating the principal gender of a fussy eater has produced conflicting results with some studies finding no difference in the gender of parent reported fussy eaters (Carruth et al., 2004; Jacobi et al., 2003) while some have found girls to be fussier than boys (Brandon, 1970; Marchi & Cohen, 1990), further research investigating gender differences in the development of food fussiness is required.

1.6 Dietary Intake of Fussy Eaters

Several researchers have investigated the dietary profile of fussy eaters with the general finding that food fussiness adversely influences dietary variety, quality and optimal nutrient intake. There is evidence that fussy eaters have a tendency to avoid particular food groups. Galloway, Fiorito, Lee, and Birch (2005) found that fussy eaters failed to meet the fruit and vegetable recommendation in the US Food Guide Pyramid (USDA, 2000), consuming fewer servings than non-fussy eaters. These findings have also been replicated in more recent studies (e.g., Cardona Cano et al., 2016; Haszard, Skidmore, Williams, & Taylor, 2014; Li et al., 2017; Tharner et al., 2014). Besides fruits and vegetables, fussy eaters have been found to reject broader food groups. Using a Food Preference Questionnaire, Jacobi et al. (2008) found that fussy eaters avoided food in general in comparison to non-fussy eaters and tended to avoid dairy products, fruits, vegetables, meat, fish, fast food, noodles, rice, potatoes and beverages specifically. Similarly, Tharner et al. (2014) administered a food frequency questionnaire (FFQ; Feunekes, Van Staveren, Graveland, Vos, & Burema, 1995) to parents of 14-month-old Dutch children to identify the food groups associated with food fussiness. Tharner et al. (2014) used a latent profile approach to identify fussy eaters, who were characterised by a pattern of low scores of the food approach scales and high scores on the food avoidance scales of the CEBQ (Wardle et al., 2001). It was found that children identified as fussy eaters consumed fewer whole grain products, fewer vegetables, less fish/seafood and less meat at 14 months than those identified as non-fussy eaters. This study also found that fussy eaters consumed more savoury snacks and confectionary than non-fussy eaters.

The finding that fussy eaters have a less varied diet in comparison to non-fussy eaters has consistently been observed across several cultures. In the US, Carruth et al. (1998), measured food intake in two-year olds using two- day food records and 24-hour recall obtained from mothers to obtain dietary variety and diversity scores, which were found to be significantly lower in fussy eaters in comparison to non-fussy eaters. Similarly, in the US, Jacobi et al. (2003) assessed dietary variety in 4-5-year-old children and found that fussy eaters had less variety in their diets in comparison to non-fussy eaters. Similar findings were obtained with two-year-old children in the UK (Northstone & Emmett, 2013), with 6 - 60-month-old children in China (Li et al., 2017; Volger et al., 2017) and with 14-month-old children in the Netherlands (Cardona-Cano et al., 2016).

Research investigating the effect of food fussiness on nutrient intake has used varying methods to measure dietary intake. Studies in which dietary intake have been assessed using food records and 24-hour recall have provided mixed results. For example, Carruth et al. (1998) found no difference in the intakes of zinc, calcium, vitamins D and E between two-year-old fussy and non-fussy eaters. Similarly, Galloway et al. (2005) found no differences in protein, carbohydrate and fat as a percentage of energy between nine-year-old female fussy and non-fussy eaters. Dubois et al. (2007) however using 24-hour recall found lower fat and protein energy intakes in fussy eaters in comparison to non-fussy eaters aged 2-4 years. Studies, however, that have referenced the nutrient intake of fussy eaters against a recommended nutrient intake (RNI) index, have reported the nutrient intake of fussy eaters to be below the recommended requirement. For example, Kim et al. (2006) found the thiamine, vitamin E and niacin intake in 12-24-month-old fussy eaters to be below the Korean recommended requirement. Similarly, Volger et al. (2017) found that the iron, calcium, zinc, vitamins A, C and D intake in 2 -5-year-old fussy eaters fell behind the Chinese recommended dietary allowance. The intake of dietary fibre has also been found to be lower in fussy eaters in comparison to non-fussy eaters. Galloway et al. (2005) found that 9-year-old female fussy eaters consumed significantly lower dietary fibre than non-fussy eaters. Similar findings were also observed in younger children aged 2-5 years (Kwok, Ho, Chow, So, & Leung, 2013; Volger et al., 2017)

Fussy eaters have also been found to consume fewer calories than non-fussy eaters. In their Stanford Growth Study of 135 children aged 5 years, Jacobi et al. (2003) found fussy eaters to consume fewer calories than non-fussy eaters. Similarly, Dubois et al. (2007) found that in addition to having lower fat and protein energy intake as described above, fussy eaters were also found to consume fewer calories in comparison to non-fussy eaters.

1.7 Consequences of Food Fussiness on Health and Wellbeing

The preceding literature has reviewed studies that have examined the dietary profile of fussy eaters which is generally one lacking in the consumption of fruits and vegetables. Fussy eaters have limited dietary variety (Carruth et al., 1998; Galloway et al., 2005; Northstone & Emmett, 2013), tend to exclude whole food groups (Galloway et al., 2005; Tharner et al., 2014), consume fewer calories (Dubois et al., 2007; Jacobi et al., 2003), deficient in essential nutrients (Kim et al., 2006; Volger et al., 2017) and have a preference for foods high in fats and sugars over fruit and vegetables (Tharner et al., 2014). Eating a diverse, balanced and healthy diet helps confer protection against a variety of risks and the key to a healthy diet involves the inclusion of all food groups comprising of dairy, grains, lean meats, poultry, fish, legumes, fruits and vegetables (WHO, 2004). The evidence that food fussiness is associated with poor nutrition is of concern. The section below will discuss the implications of fussy eaters' dietary pattern on health outcomes.

1.7.1 Implications for Children's Current Health

Food fussiness has consistently been found to be associated with the avoidance of fruits and vegetables (Carruth et al., 2004; Galloway et al., 2003; Jacobi et al., 2003). Current UK guidelines recommend that children aged one year and over should consume at least five portions of fruits and vegetables daily (NHS, 2011). With regards to portion sizes for children, it is recommended that the amount should be dependent on the age of the child, body size and physical activity levels and the amount that can be fitted in the child's palm is an approximate portion size (NHS, 2013). The basis for these guidelines is the substantial body of evidence demonstrating that fruit and vegetables confer protection against disease (Key, Appleby, Thorogood, & Burr, 1996; Rekhy & McConchie, 2014).

Fruit and vegetables, especially in their raw state and particularly bitter tasting fruits and vegetables such a grapefruit, broccoli, brussel sprouts and cabbage are good sources of dietary fibre (Tharner et al., 2015). Higher dietary fibre intake is associated with lower prevalence of constipation in children (Glackin, Fraser, & O Neill, 2008; Jennings, Davies, Costarelli, & Dettmar, 2009). It therefore follows, that the key health risk posed by avoidance of fruits and vegetable by children is functional constipation (Tharner et al., 2015). Constipation is characterised by infrequent bowel movement and difficult stool passage (Locke III, Pemberton, & Phillips, 2000). It affects up to a third of children in Western countries, affecting their quality of life and putting additional strain on healthcare systems (Van den Berg, Benninga, & Di Lorenzo, 2006; Youssef, Langseder, Verga, Mones, & Rosh, 2005).

As previously discussed, research has shown food fussiness to be associated with the consumption of fewer calories (e.g., Dubois et al., 2007; Jacobi et al., 2003) and with inadequate nutrient intake (e.g., Kim et al., 2006; Volger et al., 2017). Caloric restriction and inadequate nutrients in the diet could lead to malnutrition which refers to deficiencies or imbalances in a person's intake of energy and/or nutrients (Martorell, 1999). While a direct link between food fussiness and malnutrition has not been established in childhood, incidences of food fussiness has been reported in the elderly and has been found to be associated with an increased risk of malnutrition in this group (Maitre et al., 2014).

It has previously been reported that fussy eaters avoid food in general including meat, fish and fast foods (Jacobi et al., 2008). Tharner et al. (2014), however provide conflicting findings with evidence that fussy eaters have a preference for processed and ultra-processed foods such as cookies, potato chips and fast foods over fruits, vegetables and whole grain products. Processed foods are food products formulated mainly or entirely from processed ingredients usually containing little or no whole foods (Monteiro, Moubarac, Cannon, Ng, & Popkin, 2013; Rauber, Campagnolo, Hoffman, & Vitolo, 2015). These foods are nutritionally unbalanced as they are usually energy dense, contain large amounts of saturated and trans fats, free sugars and sodium, high glycaemic loads and contain little or no fibre and micronutrients that are naturally present in foods (Monteiro et al., 2013). Consumption of processed foods has been found to play a role in the development of chronic diseases. Rauber et al. (2015) found that the consumption of processed foods in children aged 3-4 years was a significant longitudinal predictor of increased LDL cholesterol levels at ages 7-8 years which could predispose children to early atherosclerotic changes associated with cardiovascular disease.

As highlighted above, the diet of fussy eaters characterised by the avoidance of fruits and vegetables, the consumption of an inadequate variety and insufficient calories as well as a preference for processed foods can have detrimental consequences. The main issue is likely constipation and poor nutrient intake, however in extreme cases, there could be broader health implications.

1.7.2 Implications for Children's Future Health

Food preferences and habits tend to develop very early in childhood (Birch & Fisher, 1998) and likely persist into adulthood (Kelder, Perry, Klepp, & Lytle, 1994; Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2004; Savage et al., 2008). As described above, a few studies have found stability in food fussiness from childhood into adulthood (e.g., Marchi & Cohen, 1990; Nicklaus et al., 2005). It has also been found that a child's early nutritional experiences contribute to the development of disease in adulthood, a concept termed metabolic imprinting (Hales & Barker, 2001). Consequently, the avoidance of fruits and vegetables by fussy eaters could result in detrimental health outcomes later in life.

For decades, medical and nutritional research have emphasized the health benefits associated with fruit and vegetable consumption which include a reduced risk for the development of various chronic and debilitating diseases (Rekhy & McConchie, 2014). There is a body of research highlighting the potential cancer prevention benefits of fruit and vegetable consumption (Boffetta et al., 2010; Reiss, Johnston, Tucker, DeSesso, & Keen, 2012). For example, breast cancer has been ranked as the first major cause of death among women globally with an estimated 55,000 newly diagnosed cases in the UK (WHO, 2013). The intake of cruciferous vegetables such as cabbage, broccoli, cauliflower and Brussel sprouts has been shown to be inversely associated with the risk of developing breast cancer (Liu & Lv, 2013; Verhoeven, Goldbohm, Poppel, & Verhagen, 1996). There are also reports that consuming fruits and vegetables protect against cancers of the mouth, pharynx, larynx, oesophagus, lungs and stomach (World Cancer Research Fund/ American Institute for Cancer Research; WCRF/ AICR, 2009). It is proposed that fruits and vegetables protect against cancer because they contain bioactive compounds such carotenoids, glucosinolates, folic acid and flavonoids which suppresses the formation of cancer-causing carcinogens (Eberhardt, Lee, & Liu, 2000).

Cardiovascular diseases (CVD), which are a group of heart and blood vessel disorders, are the leading cause of death worldwide, representing 31% of global deaths in 2012 (WHO, 2015). There is considerable evidence demonstrating that the consumption of fruits and vegetables lowers the risk of developing CVD (Liu et al., 2000; Nöthlings et al., 2008). It has been hypothesized that bioactive components found in fruits and vegetables such as carotenoids and antioxidants (e.g. vitamin C) may hinder the risk of CVD by lowering blood pressure (Dohadwala & Vita, 2009).

In addition to reduction in risk for cancer and CVD, increased consumption of fruits and vegetables is a significant reduction in the risk of obesity in both children and adults. Obesity has been reported to be a potential risk factor for the development of heart disease, certain cancers and Type 2 diabetes in adulthood (Riboli et al., 2002). For example, Xu et al. (2013) found that overweight children aged 6-13 years who consumed high amounts of fruit and vegetables were less likely to remain overweight at a two year follow up in comparison to overweight controls that had a diet lower in fruit and vegetable. Similar findings have been obtained from adult studies with a consistent association between higher fruit and vegetable consumption and lower weight status being (He et al., 2004; Ledoux, Hingle, & Baranowski, 2011). Fruits and vegetables are energy dense foods, high in water and fibre and increased consumption has been shown to contribute to decreased overall energy intake resulting in obesity reduction (Olsho et al., 2015).

Growth retardation in early childhood as a result of malnutrition caused by caloric restriction and inadequate nutrients in the diet has been found to be associated with significant functional impairment in adulthood (Onis, Frongillo, & Blössner, 2000). In a longitudinal study, children with growth retardation at age two were found to have lower cognitive skills at age 25 with poor performance in tests of reading and intelligence (Hoddinottet al., 2011). As previously discussed, while a direct link between malnutrition and food fussiness has not been established in young children, this finding seems to suggest that children who are extremely fussy, therefore have restricted caloric intake which may lead to growth retardation may be at risk for reduced intellectual achievement in adulthood.

1.7.3 Implications for BMI

BMI, a simple anthropometric measure of weight divided by squared height is the most widely used tool for overweight and obesity (Duncan, Duncan & Schofield,2009) and is a reasonably good measure of general adiposity (Hu, 2008). BMI has an effect on health outcomes indirectly linked to heart disease, cancer and type 2 diabetes. Research on the impact of food fussiness on children’s BMI is inconclusive. Some studies have reported an association between food fussiness and the risk of being underweight while other studies have reported a relationship between food fussiness and overweight risk. Wright et al. (2007) found that children classified as fussy eaters gained less weight during the first two years of life possibly as a result of food refusal, lack of interest in food and consuming small amounts of food. Likewise, in a longitudinal questionnaire study of children aged 2.5 to 4.5 years, Dubois et al. (2007) found fussy eaters at increased risk of being underweight in comparison to non-fussy eaters. Food fussiness status was determined by mothers' report of three criteria: 1) children who always eat a different meal from that eaten by the rest of the family 2) children who often refused to eat the meal prepared by the mother and 3) children who often refused to eat. Dietary intake was derived using 24-hour recall. As previously described, fussy eaters tended to consume less energy, fat and proteins and were also found to be generally underweight with a low BMI at 4.5 years in comparison to children who were not fussy eaters. A similar trend was observed by Ekstein, Laniado, andGlick(2010) who took weight-for-length measurements from fussy and non-fussy children with a mean age of 37 months and found a significant association between food fussiness and being underweight. In contrast, Finistrella et al. (2012) found an association between food fussiness and the risk of being overweight in children aged 2-6. In this cross sectional study, food fussiness was assessed using the Child Feeding Questionnaire (CFQ; Birch et al., 2001) measuring three behaviours: (1) my child's diet consists of only a few foods (2) my child is unwilling to eat many of the foods the family eats at mealtimes and (3) my child is fussy or picky about what he/she eats. Food intake was assessed using a food frequency questionnaire and children's BMI were calculated. It was found that overweight and obese children were significantly fussier than normal-weight children. In explaining these findings, it has been suggested that a tendency for fussy eaters to replace strongly disliked fruits and vegetables with carbohydrate-based foods such as biscuits and crisps which are high in sugar, salt and fat content (e.g., Carruth et al., 2004; Dovey et al., 2008; Tharner et al., 2014; Timimi, Douglas, & Tsiftsopoulou, 1997) may have accounted for higher BMI.

To support Finistrella et al. (2012), it seems plausible that there are two types of food fussiness; fussy eaters who consume limited amount of foods and fussy eaters who consume a good amount of unhealthy foods. This is evident in Goh and Jacob, (2012) study which explored the perception of food fussiness amongst Singapore parents. It was found that 13.3% of parents perceived food fussiness to involve the consumption of sweets and fatty food rather than healthy foods while 20.6% perceived food fussiness to involve food refusal and eating very little food. Conflicting results found in research investigating the relationship between food fussiness and BMI therefore can partly be attributed to different assessment methods and conceptualisation of food fussiness between studies. For example, Dubois et al. (2007) conceptualised food fussiness as refusing to eat while food fussiness was conceptualised as eating a few foods in the study by Finistrella et al. (2012). It is possible that the "few foods" consumed by fussy eaters in the latter study may have consisted of mainly energy dense foods accounting for their higher BMI. In addition, the different criteria for defining overweight between studies could also account for conflicting results. For example, Dubois et al. (2007) and Ekstein et al. (2010) defined overweight as having a BMI at or above the 95th percentile on the Centres for Disease Control and Prevention reference charts (NCHS, 2000) while Finistrella et al. (2012) defined overweight as having a BMI between the 85th and 95th percentile. Due to these methodological inconsistencies, the influence of child food fussiness on BMI remains unclear. Research utilizing similar food fussiness assessment methods and conceptualisations as well as BMI criteria are needed to provide better insight into the relationship between food fussiness and BMI. The use of BMI, however, has been criticised as an imperfect proxy for adiposity as it fails to distinguish between lean and fat mass (Zilanawalaet al., 2015). In addition, BMI may be less strongly affected in young children who might be short in stature and of low weight. For example, poor nutrition may result in stunted growth in children affecting both weight and height but because BMI takes height and weight into account to determine weight, such children will fall into the normal weight range and will not be classified as being underweight.

1.7.4 Implications for Food Preferences in Adulthood

Food fussiness has been found to strongly influence adults' food choices and preferences. Food fussiness has often been referred to as a transient childhood phase, however emerging research has revealed that food fussiness is quite common in adults (e.g., Marchi & Cohen, 1990; Nicklaus et al., 2005). Prolonged duration of food fussiness in childhood has been found to be associated with its persistence into adulthood and there is also evidence of new cases of food fussiness occurring in young adulthood (e.g., Van Tine, McNicholas, Safer, & Agras, 2017). Kauer, Pelchat, Rozin, & Zickgraf, (2015) found that approximately 35% of adults in a community sample described themselves as fussy eaters. In this study, however, Kauer et al. (2015) did not enquire about the adults' childhood food fussiness status making it unclear whether food fussiness in this sample had persisted from childhood or whether these were new cases which had begun in adulthood. Adults who identify as fussy eaters tend to mirror the eating behaviours of children classified as fussy eaters including the reluctance to try new foods, having limited dietary variety and a preference for special meals (Van Tine et al., 2017). Zickgraf and Schepps (2016) found that adult fussy eaters reported consuming fewer servings of fruits and vegetables and dietary fibre in comparison to typical eaters. Adult food fussiness has also been found to be associated with unhealthy eating behaviours including a preference for increased consumption of desserts, snacks and sodas as well as reduced fish and meat consumption (Zickgraf & Schepps, 2016).

1.7.5 Implications for the development of Eating Disorders

Another potential health consequence of food fussiness is its association with serious eating disorders in adolescence and adulthood. Prospective studies have investigated eating behaviours at varying time points. These studies have produced mixed results regarding how food fussiness in childhood relates to the development of eating disorders in adulthood. Marchi and Cohen (1990) investigated problematic eating behaviours in children over a 10-year period from early and middle childhood to late childhood and adolescence. Six problematic eating behaviours including food fussiness were measured by interviewing mothers at three different intervals; when their children were aged anywhere between 1 to 10, between 9 to 18 and 2.5 years later when their child was aged between 12 to 20). Marchi and Cohen (1990) found food fussiness to be relatively stable across the 10-year period and that food fussiness in early childhood strongly predicted symptoms of anorexia nervosa in adolescence.

In contrast, Kotler, Cohen, Davies, Pine, and Walsh (2001) failed to find an association between food fussiness in childhood and anorexia nervosa in early adulthood. They examined the relationship between eating problems experienced in childhood, adolescence and adulthood. Structured interviews based psychiatric assessments were carried out on both mothers and children at four time points over a 17-year period. The time points were as follows: Time 1 (childhood; mean age =6.1 years old) Time 2 (early adolescence; mean age = 13.9 years old), Time 3 (late adolescence; mean age = 16.3 years old) and Time 4 (early adulthood; mean age =22.1 years old). Six problematic eating behaviours including food fussiness were assessed using maternal interviews. Kotler et al. (2001) found that children who experienced eating conflicts, struggles around meals and unpleasant mealtimes in childhood were more likely to be diagnosed with anorexia nervosa in early adulthood but did not find food fussiness to be predictive of symptoms of anorexia nervosa. Consistent with Kotler et al. (2001), Dellava et al. (2013) also failed to find an association between maternal recall of food fussiness in childhood and subsequent development of anorexia nervosa in young adulthood. However, caution is needed in the interpretation of this study's finding due to the retrospective design and its reliance on maternal recall of the child's eating behaviour which may have been subject to recall bias.

Kotler et al. (2001) found that unpleasant mealtimes in childhood along with eating conflicts and struggles are important factors for the development of anorexia nervosa. These behaviours have been found to be associated with food fussiness and reported by parents of fussy eaters (e.g., Goh & Jacob, 2012; Timimi et al., 1997). It may be that mealtime struggles experienced by fussy eaters during childhood as a result of parent concern regarding their limited consumption are a risk factor for the development of eating disorders in adulthood, as observed by Marchi and Cohen (1990).

Conversely, it may be that fussy eaters who do not experience mealtime struggles in childhood probably due to their parents providing an alternate meal are less likely to develop eating disorders in adulthood, research exploring this possibility is required.

1.7.6 Implications for Children’s Psychopathology

Few studies have examined associations between children’s food fussiness and the development of mental health problems. Jacobi et al. (2008) investigated associations between food fussiness and child psychopathology in children ages 8-12 years. Food fussiness was measured by asking parents to respond to the question “is your child a fussy eater?”, answers were “yes” and “no”. Parents completed the Child Behaviour Checklist (CBCL; Achenbach, 1991) which measured behavioural problems and social competencies. The CBCL measures “internalising behaviours” such as attention problems, withdrawn, social problems, somatic complaints, thought problems and anxiety/depression and externalising problems such as delinquent and aggressive behaviour. Jacobi et al. (2008) found food fussiness to be associated to both internalising and externalising behaviours. Children categorised as fussy eaters were reported as having more symptoms of withdrawal, somatic complaints, anxiety and depression symptoms and higher levels of aggression and delinquent behaviour. Similarly, elevated levels of anxiety and depression have been reported in children with moderate levels of food fussiness (Zucker et al., 2015). However, as both of these studies were cross-sectional, inferences cannot be made about the temporal associations between food fussiness and child psychopathology.

1.7.7 Implications for Parents health

Besides the health risks posed by food fussiness, this selective eating style has been shown to promote parental stress. Goh and Jacob (2012) interviewed caregivers of fussy eaters aged 1-10 years regarding the impact of food fussiness on family relationships. It was reported that food fussiness was associated with reports of caregiver stress during feeding and negative impact on family relationships. Similarly, Trofholz, Schulte, and Berge (2017) in their qualitative study found that parents expressed frustration and stress due to their child's food fussiness during mealtimes. Parents were usually frustrated and stressed about food wastage associated with food fussiness and the need to provide a separate meal. Some parents of fussy eaters have reported a tendency to avoid socializing with other families due to concerns about their children's restricted diet and refusal to eat in the presence of strangers (Timimi et al., 1997). Although these findings are consistent with the possibility that food fussiness causes parental stress, causal relationships between parents' stress and child food fussiness cannot be analysed from cross sectional data. An alternative direction could be that parents stress may lead to child food fussiness. This is plausible as parents who are under stress may have negative feeding interactions with their children and use maladaptive feeding practices which may result in food fussiness.

Food fussiness has also been found to be associated with increased childhood behavioural problems including internalizing and externalizing behaviours potentially contributing to parental stress during mealtimes. Fussy eaters have been found to display more attention problems, thought problems, higher levels of aggression towards their parents and siblings and delinquent behaviour in comparison to non-fussy eaters (Jacobi et al., 2008; Timimi et al., 1997). Due to these behavioural problems, parents of fussy eaters have referred to their children as being manipulative and disruptive during mealtimes and have also described mealtimes as being a laborious and feared task (Timimi et al., 1997).

The impact of behavioural problems associated with food fussiness on parents' emotional well-being was explored in detail by Hagekull and Dahl (1987). In this study, Hagekull and Dahl (1987) conducted structured interviews to examine maternal experiences and emotions when feeding their fussy infants. 84 Swedish families with infants aged from 3 -12 months were recruited to participate in the study. Maternal reports covering aspects of the infant's behaviour at mealtimes, maternal emotions, social relations as well as facts relating to feeding experiences with the infant such as frequency of feeds and length of feeding were obtained through structured interviews. Based on these reports, infants were allocated to either an eating problem group or a control group. It was observed that mothers of infants with eating problems such as food fussiness reported more irritable and disruptive infant behaviour during mealtimes, more social isolation and had significantly more negative experiences and emotions. It should be noted that the possibility of bidirectional effects cannot be ruled out here. Therefore, it is plausible that social isolation experienced by mothers as well as their negative emotions and experiences may lead to negative mother-child interactions resulting in more irritable and disruptive infant behaviour during mealtimes.

1.7.8 Summary

Food fussiness has been found to have a negative impact on children's dietary patterns and the intake of vital nutrients needed for optimal development. Fussy eaters restrict their intake of fruits and vegetables, have inadequate nutrient and caloric intake, tend to avoid whole food groups, have a preference for foods high in fat and have less dietary variety than non-fussy eaters. The literature reviewed above demonstrates that the dietary pattern associated with food fussiness imposes serious consequences on children's current and future health. The lack of fruits and vegetables has been linked to functional constipation while a preference for processed foods in early childhood has been linked to increased cholesterol levels in late childhood. In addition, restricted caloric and nutrient intake in early childhood could result in malnutrition which is associated with poor cognitive development in late childhood. Food fussiness has often been regarded as a transient phase for many children, resolving with increasing child age, however, there is evidence of its stability into adulthood, an adult diet lacking in fruits and vegetables has been associated with the development of cancer, type 2 diabetes and cardiovascular disease. Food fussiness has also been found to lead to conflict between the parent and child during mealtimes causing familial stress and is a possible risk factor for children's mental health and the development of life-threatening eating disorders in adulthood. Given the negative associations between food fussiness and health outcomes in children and adults, preventing its onset is important. However, a good understanding of the factors that are associated with the development of food fussiness is essential for prevention.

1.8 Selection of variables to be included in thesis

Variables to be examined in this thesis were selected on the basis of the Biopsychosocial approach (Engel, 1977) which systematically considers the role of biological, psychological and social factors and their complex interactions in understanding feeding problems. Applying this model, Berlin, Davies, Lobato and Silverman, (2009) highlight factors that have been implicated in the development and maintenance of child feeding problems including food fussiness in both typical and clinical populations. Biological factors refer to innate personality dispositions or associated conditions that predispose individuals to developing feeding problems (Berlin et al., 2009). Satter (1986, 1995, 1999) proposed that various characteristics of the child and parent outside the feeding relationship are risk factors for child feeding problems. Satter (1995) argued that children's difficult temperament disposition places them at risk of developing feeding problems which has received empirical support from various studies (e.g., Chatoor, Ganiban, Hirsch, Borman-Spurrell & Mrazek, 2000). More recently, Children's individual differences in detection and reactions to sensory information have also been found to influence child food fussiness (e.g., Steinbekk et al., 2017). It has been proposed that distal psychological factors in parents such as mental health and socio-economic variables may place children at risk for feeding problems (Satter, 1999). These factors are termed "distal" as they are assumed to have an indirect influence on feeding through their effect on parents' behaviours during meals (Berlin et al., 2009). Distal parental variables such as depression, stress, family conflict and social isolation have been implicated in child feeding problems including food fussiness (e.g., Coulthard & Harris, 1990; Goh & Jacob, 2012). Other parent psychological factors include maternal core beliefs and self- perceptions which have been implicated in children's food fussiness (e.g., Blissett, Meyer, Farrow, Bryant-Waugh, and Nicholls 2005; Farrow & Blissett, 2006). Social factors include feeding interaction and dynamics between parents and children during mealtimes. Satter (1999) argues that children are able to regulate their food intake according to caloric saturation, therefore feeding should be guided by internal cues and not by external parental feeding strategies. Satter's (1999) argument is supported by research that have found associations between parents controlling feeding practices and children's food fussiness (e.g., Birch, Marlin, & Rotter 1984). This thesis will therefore examine child temperament, child sensory hyperreactivity, maternal psychopathology, maternal core beliefs, maternal self-esteem and parents controlling feeding practices in relation to child food fussiness.

1.9 Child and Parent Correlates and Predictors of Food fussiness

The literature below will discuss child and parent characteristics that have previously been identified as correlates and predictors of food fussiness.

1.9.1 Child Temperament

There is growing evidence to suggest that child temperament plays a role in the development of child feeding problems including food fussiness. Temperament has been defined as "personal characteristics that are biologically based, are evident from birth onwards, are consistent across situations and have some degree of stability" (Schaffer, 2006, p. 70). There are several approaches to defining temperament dimensions and some inconsistency in how terms are used across the literature. Thomas and Chess, (1986) focused on characterising the dimensions on which typical behaviour differed between individual infants and proposed that such differences could be attributed to an underlying biological basis (Shiner et al., 2012). In the New York Longitudinal Study (NYLS), Thomas andChess (1977) chose nine temperament characteristics after a content analysis of a series of interviews with parents of young children. These characteristics include activity level, rhythmicity, approach/withdrawal, adaptability, intensity of reaction, threshold of responsiveness, quality of mood, distractibility and attention span/persistence. Based on the combination of the nine characteristics, Thomas and Chess (1977) asserted that many children fall into three temperament categories: easy, difficult and slow to warm up. These categories were subsequently replaced by a dimension, ranging from easy to difficult, which aligns with how most parents evaluate their children: as easy to handle or causing problems for the parents (Plomin & Buss, 1984). The easy-difficult dimension, however posed some conceptual problems as Thomas and Chess failed to specify the criteria for easy or difficult temperaments. For example, there are diverse ways a child could be regarded as difficult, an extremely active child can be termed difficult if the parent prefers a less active child and a child who demands attention can also be labelled as difficult (Plomin & Buss, 1984). More recently, through the application of more sophisticated statistical methods, the three temperament categories of easy, difficult and slow to warm up have received empirical support with some researchers re-labelling them as "resilient", "under controlled" and "overcontrolled" (Capsi & Shiner, 2006). Some researchers have recognised that particular patterns of traits are not necessarily perceived as "difficult" for all parents and have substituted the term "difficult child" with more descriptive labels such as "resistant to control" (Bates, Pettit, Dodge, & Ridge, 1998) and "high maintenance" (McClowry, 2002). Thomas and Chess' NYLS conceptualization of temperament formed the basis for the development of several temperament questionnaires such as the Baby Behaviour Questionnaire (BBQ; Hagekull, 1985), Toddler Behaviour Questionnaire (TBQ; Hagekull, 1985) and the Infant Characteristics Questionnaire (ICQ; Bates, Freeland, & Lounsbury, 1979). These questionnaires assess several dimensions of the NYLS temperament dimensions including difficult temperament, which is defined as the propensity to become easily distressed and being too difficult to be managed by parents.

Similar to Thomas and Chess, Buss and Plomin (1984) proposed that temperament had a biological basis and could be considered a set of inherited personality traits that appear early in life. Buss and Plomin defined temperament on the basis of two criteria: traits that are genetic in origin and those that appear early in infancy; specifically, the first year of life (Goldsmith et al., 1987). Using these criteria, Buss and Plomin (1984) generated a list of temperament dimensions which included emotionality, activity, shyness and sociability. Emotionality is somewhat aligned to Thomas and Chess (1977) difficult temperament dimension and refers exclusively to negative emotions and is the predisposition to get easily distressed and upset while activity refers to total energy output (Buss & Plomin, 1984). Sociability is the tendency to prefer the presence of others to being alone while the dimension of shyness is the tendency to be nervous or timid in the company of people. Sociability differs from shyness as individuals who are shy may want to be in the presence of others but avoid it because they tend to be tense and anxious in the presence of others (Buss & Plomin, 1984). The psychometric properties of these temperament dimensions have been examined and supported in several studies. For example, Boer andWestenberg (1994) validated the EAS in a sample of Dutch children aged between 4 and 12 years and found the EAS to be reliable in terms of internal consistency and interrater agreement. Similarly, Mathiesen and Tambs (1999) confirmed the factor structure and stability of the EAS over 3 years in young Norwegian children providing support for its use with children as young as 18 months.

Consistent with previous approaches, Goldsmith and Campos (1986) also assume a biological basis for their temperament approach. Goldsmith and Campos (1986) view temperament as individual differences in the emotionality domain and defined temperament as individual variations in the propensity to experience and express emotional behaviour. According to this approach, emotionality in temperament refers to individual differences in primary positive and negative emotions. Goldsmith and Campos (1986) critiqued the classification of emotional temperament as a single temperament dimension as in Buss and Plomin’s approach and proposed five dimensions of temperament that correspond to discrete emotions: motoric activity, anger, fearfulness, pleasure/joy and interest/persistence.

Rothbart, (1981) defined temperament as constitutional genetic differences in reactivity and self-regulation. Reactivity has been described as of the ease with which the motor, affective and sensory response systems are aroused. Individual differences in reactivity are measured by the magnitude of reactivity, intensity of a given reaction, latency of response, and rise and recovery time (Zentner, Bates, & Article, 2008). In contrast, self-regulation includes behavioural processes such as avoidance, inhibition, attention and approach which serve to modulate (increase, decrease or maintain) arousal and reactivity (Zentner et al., 2008). Rothbart, Ahadi, Hershey, and Fisher

(2001) developed the Children's Behaviour Questionnaire (CBQ) to provide a measure of temperament in early childhood that aligns with the reactive and self-regulatory model of temperament. The dimensions of the CBQ were based on a factor analysis of over 20 temperament dimensions drawn from earlier temperament approaches such as the NYLS (Thomas & Chess, 1977), the EAS (Buss & Plomin, 1984), which revealed three broad dimensions of temperament: Surgency-Extraversion, Negative affectivity and Effortful control. Surgency-Extraversion has been described as positive affectivity. It is underpinned by the scales of activity level, sociability and pleasure expressed in anticipation of a reward. Negative affectivity, which is akin to difficult temperament (Thomas & Chess, 1977) and emotional temperament (Buss & Plomin, 1984) includes anger, sadness, fear, physical discomfort and recovery from distress. Effortful control has been defined as the ability to focus attention, show satisfaction during low intensity activities and to exercise inhibitory control (Shiner et al., 2012). The CBQ is a widely used measure and has been found to have good internal consistency as well as good construct and concurrent validity (Rothbart, et al., 2001).

In recent years, various researchers have critiqued the biological basis for temperament assumed by the four temperament approaches reviewed above. It has been argued that before birth, the expression of the child's genetic material has already been influenced by the intrauterine environment (Huizink, Zentner, & Shiner, 2012) and experiences continue to determine gene expression after birth (Champagne & Mashoodh, 2009). Therefore, it makes sense that temperament should be viewed as a result of a combination of biological and environmental factors throughout development (Bates et al., 1998; Shiner et al., 2012).

The following section will review literature that has investigated the relationship between various dimensions of child temperament and child feeding problems including food fussiness.

1.9.1.1 Difficult Temperament

Research examining the association between difficult child temperament and food fussiness have used measures that were developed based on Thomas and Chess

(1977) NYLS theory of temperament and assess similar temperament dimensions. Cross sectional studies have found that children with eating problems including food fussiness are more likely to have a difficult temperament in comparison to controls. For instance, using the Infant Characteristics Questionnaire (ICQ; Bates et al., 1979) to assess child temperament, Chatoor et al. (2000) found that fussy eaters with a mean age of 21 months were perceived by their mothers as having a difficult temperament. Similarly using the ICQ, Farrow and Blissett (2006) found difficult temperament to be associated with food refusal and negative mealtimes in six-month-old infants. Further, using the Children's Behaviour Questionnaire (CBQ; Rothbart et al., 2001), Brown et al. (2018) found difficult temperament to be associated with food fussiness in children aged 3-4 years. Longitudinal data also show an association between difficult child temperament and child eating problems. For example, Hagekull, Bohlin, Rydell, and Mothander (1996) observed a positive association between difficult child temperament measured using the Baby Behaviour Questionnaire (BBQ; Hagekull, 1985) and the Toddler Behaviour Questionnaire (TBQ; Hagekull, 1985) at 4, 10 and 15 months and food refusal behaviours including food fussiness at 2 years.

1.9.1.2 Shy Temperament

Research examining the role of shy temperament in child food fussiness has either used Thomas and Chess (1977) definition of shyness (withdrawal) or the definition of shyness provided by Buss and Plomin (1984). An association has been found between shy temperament (Buss & Plomin, 1984) and food fussiness. Kagan and Snidman (1991) proposed that shy and timid children may be reserved when faced with unfamiliar situations and are likely to extend such reservations to their relationships with food. Similarly, children with eating problems including food fussiness have been found to be less talkative and to avert their gaze during feeding and non-feeding situations (Chatoor, Hirsch, Ganiban, Persinger, & Hamburger, 1998). Conversely, children who are high in approach, which is the antithesis to Withdrawal (Thomas & Chess, 1977) and to Buss and Plomin's shy temperament, are more accepting of new foods, infants who scored high on approach were more likely to accept and eat an unfamiliar green vegetable in comparison to infants scoring low on approach (Forestell &

Mennella, 2012; Moding & Stifter, 2016). Pliner and Loewen (1997) experimentally investigated the relationship between child temperament using the EAS (Buss & Plomin, 1984) and eating problems in children aged 5-11 years. Children were presented with unfamiliar food items and were asked if they would like to taste the foods. It was found that shy temperaments were positively associated with the rejection of unfamiliar foods, a characteristic of food fussiness. That is children perceived by their mothers as having shy temperaments were more reluctant to taste the unfamiliar foods.

1.9.1.3 Negative Affect

The relationship between the temperament dimension of Negative Affect, as defined by Rothbart (Rothbart et al., 2001), and food fussiness has also been explored and has produced mixed results. Using the Child Behaviour Questionnaire (CBQ; Rothbart et al., 2001) to measure child temperament, Jacobi et al. (2003) found parent-reported negative affect to be significantly associated with food fussiness in children aged 4-5 years. However negative affect at age 4 did not significantly predict food fussiness at age 6 in a longitudinal study (Steinsbekk, Bonneville-Roussy, Fildes, Llewellyn, & Wichstrøm, 2017).

1.9.1.4 Emotional Temperament

More recently, research has demonstrated a consistent relationship between emotional temperament in children and food fussiness. Emotional temperament measured using the EAS (Buss & Plomin, 1975; 1984) has been found to be associated with concurrent child feeding problems including food fussiness. For example, Pliner and Loewen (1997) found emotional temperament in children aged 5 to 11 years to be positively associated with the rejection of unfamiliar foods. Similar findings were reported by Powell, Farrow, and Meyer (2011) who found a relationship between emotional child temperament and three food avoidant behaviours including food fussiness in children aged 3-6 years. Further, Haycraft et al. (2011) examined the association between child temperament and a range of child eating behaviours and found that higher levels of child emotionality characterised by excessive crying and temper tantrums, were significantly associated with increased food fussiness in a sample of children aged 3 – 8 years. Higher levels of emotional child temperament as measured by the EAS have also been found to be a significant longitudinal predictor of food fussiness (Hafstad et al., 2013). Explanations for the association between emotional temperament and food fussiness are still not clear. It has however been suggested that due to their persistent dissatisfaction in most situations, children with higher emotional temperaments may extend this discontentment to mealtimes, showing heightened emotional reactivity and may be more difficult to feed (Hafstad et al., 2013; Haycraft et al., 2011). This may result in difficult parent-child feeding interactions and parents use of controlling feeding practices such as pressure and restriction that have been found to intensify food fussiness (Birch & Fisher, 2000; Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002). This explanation aligns with previous theoretical explanations for child behavioural problems which has been theorized as being as a result of an interaction between temperament factors and qualities of the child's social environment (e.g., Thomas & Chess, 1997). The finding that pre-school children with higher levels of temperamental manageability were less aggressive when they received high quality day care than when they received low quality care provides evidence of a temperament x environment interaction effect (Hagekull & Bohlin, 1995).

1.9.2 Parent Characteristics

Specific characteristics of the parent have also been implicated in the aetiology of child feeding problems including food fussiness. While there is general agreement that a father's influence is important for child development (Lamb, 2004), the majority of research examining parental influence on child eating behaviours has focused on the role of the mother. There are several reasons for giving maternal factors priority over paternal factors in explaining child food fussiness. First, maternal characteristics appear to play a more important role than paternal characteristics in the development and the sustaining of child eating problems. For example, Wertheim, Mee, and Paxton(1999) compared maternal and paternal use of restriction to encourage weight loss in their daughters and found maternal use of restriction to be more influential than paternal use of restriction in predicting dietary restraint. Second, in general, mothers take more responsibility than fathers in the child feeding process and spend significantly more time than fathers interacting with the children across various familial situations including mealtimes (Blissett & Haycraft, 2011; Blissett, Meyer, & Haycraft, 2006; Craig, 2006; McHale, 1995). Finally, mothers have been found to offer to take part in research as the primary caregiver with several studies reporting response rate of less than 10% from fathers when completing questionnaires directed at parents/caregivers (e.g., Patrick & Nicklas, 2005; Wardle, Carnell, & Cooke, 2005). This may be because fathers are more likely to work full time (e.g., Bakker, 1988; Brayfield, 1992) which means that they may feel they have less time to take part in research and that they are less likely to consider themselves to be the child's primary caregiver. This thesis will therefore focus on the relationship between maternal characteristics and food fussiness.

1.9.2.1 Maternal Psychopathology

One maternal factor that has been evaluated in relation to fussy eating is psychopathology. There is a body of research linking maternal symptoms of psychopathology to a range of child feeding problems including food fussiness. Cross-sectional studies have found an association between maternal symptoms of depression and anxiety and children's food fussiness. For example, Blissett, Meyer, and Haycraft (2007) examined the association between maternal symptoms of anxiety and depression and food fussiness in children aged between 13 and 49 months. It was found that maternal anxiety and depression predicted reports of negative feeding interactions and of food fussiness but only in male children. In contrast, maternal symptoms of Bulimia Nervosa and depression significantly predicted reports of food fussiness in female children, but not male children, when symptoms of anxiety were controlled for. Blissett et al. (2007) concluded that different aspects of maternal psychopathology may influence feeding problems in boys and girls differently.

Similarly, Ammaniti, Lucarelli, Cimino, D'Olimpio, and Chatoor (2010) found higher levels of anxiety and depression in mothers of children aged 6-36 months classified as fussy eaters. However, cross-sectional designs hinder firm conclusions to be made about the direction of causality in the relationship between maternal symptoms of psychopathology and food fussiness. It is not clear whether maternal symptoms of anxiety and depression cause food fussiness or whether mothers' concern about food fussiness in their children elicits higher levels of depression and anxiety. Longitudinal research allows temporal associations between variables to be evaluated, which can provide insight into causal associations. A few longitudinal studies have examined the link between maternal symptoms of psychopathology and food fussiness, but results have been somewhat inconsistent. Coulthard and Harris (2003) examined the role of maternal depression and anxiety in the onset and maintenance of infant food refusal. Coulthard and Harris assessed depression, state and trait anxiety in mothers when their infants were 1 month, 5 months and 11 months. State anxiety is a transient phase and refers to how an individual feels "right now" while trait anxiety reflects how an individual generally feels most times and is relatively stable. Infant food refusal was assessed when infants were 11 months old using the Child Feeding Assessment Questionnaire (CFAQ; Harris & Booth, 1992) with the criteria that infant should have displayed food refusal for a period of one month for it to be classified as food refusal. Maternal depression and anxiety scores at 1 month, 5 months and 11 months were found not to differ according to child food refusal at age 11 months, an indication that the onset of food refusal is likely not caused by maternal depression or anxiety. Several variables, however predicted whether periods of food refusal were ongoing or resolved at 11 months. It was also observed that mothers of infants with ongoing food refusal at 11 months had significantly higher state anxiety and depression scores at 11 months but not at 1 month and 5 months. There was no significant difference, however, in the trait anxiety scores between mothers of infants with resolved and ongoing food refusal at 1 month, 5 months and 11 months. Coulthard and Harris (2003) suggested that the anxiety experienced by mothers of children with ongoing food refusal is transient as higher trait anxiety scores would have been expected at all three time points if mothers of infants with ongoing food refusal were generally anxious. The authors concluded that the elevated state anxiety scores seen in mothers of infants with ongoing food refusal at 11 months was a consequence of their child's feeding problem.

The absence of a significant difference in state anxiety scores between mothers of infants with ongoing food refusal at 1 month and 5 months which was problem free in terms of feeding supports this conclusion.

In contrast, McDermott et al. (2010) provided evidence that maternal symptoms of psychopathology are causal factors for the development of food fussiness. In this study, food fussiness was assessed via maternal report when children were 6 months, 5 years and 14 years old. Maternal depression and anxiety were also measured when children were 6 months and 5 years respectively. Persistent maternal anxiety during the child's early years (from 6 months to 5 years) was found to be a significant predictor of food fussiness at age 14, an indication that food fussiness might be a consequence of maternal symptoms of psychopathology. However, this study failed to control for early child food fussiness when considering the relationship between maternal anxiety and food fussiness. It is possible that maternal concern about the child's fussiness in the early years may have resulted in maternal anxiety.

Most studies investigating the link between maternal symptoms of psychopathology and food fussiness have assessed postnatal maternal anxiety and depression where elevated maternal symptoms could be attributed to maternal concerns about the effect of food fussiness on the child's health. Assessing prenatal maternal anxiety and depression overcomes this issue because maternal concerns about their child's food fussiness are necessarily absent. Thus, assessing prenatal anxiety may shed more light on the direction of the association between maternal symptoms of psychopathology and food fussiness. De Barse et al.(2016) measured symptoms of psychopathology in mothers during mid-pregnancy and again when the child was 3 years old and measured food fussiness when the child was 3 and 4 years old. It was found that higher maternal symptoms of depression and anxiety in the antenatal period as well as at 3 years postnatal predicted elevated food fussiness when the child was 4 years. Because mothers' symptoms of psychopathology were measured in the antenatal period, elevated levels of depression and anxiety in mothers at this stage could not have been a reaction to their child's food fussiness. Consequently, De Barse and colleague's findings provide strong evidence that the direction of causality in the relationship between maternal symptoms of psychopathology and food fussiness is from the mother to the child.

In explaining the association between maternal psychopathology and food fussiness, there are suggestions that difficult mother-child feeding interactions and controlling maternal feeding strategies may play a mediating role (Micali et al., 2011). Specifically, it has been proposed that maternal symptoms of depression, anxiety and stress may impair the interaction between mother and child which may result in mothers becoming less involved with their child and using less sensitive and controlling strategies to cope with their perception of their child's food fussiness, which may in turn exacerbate the feeding problem (Coulthard & Harris, 2003; Haycraft & Blissett, 2008; Micali, Simonoff, Stahl, & Treasure, 2011). For example, maternal stress as a result of difficult and challenging life situations has been found to interfere with parenting, culminating in the use of controlling and uninvolved parenting practices (Gordon, 2003). Similarly, Hurley, Black, Papas, and Caulfield (2008) found that mothers with higher levels of depression, anxiety and stress reported using more controlling feeding strategies with their infants. These findings were replicated by Mitchell, Brennan, Hayes, and Miles (2009) who also found that mothers with symptoms of depression, anxiety and stress reported feeling less satisfied in their role as parents and were more inclined to use controlling feeding practices.

In summary, a number of studies have demonstrated an association between maternal mental health and children's food fussiness and there is emerging evidence indicating that maternal mental health may play a causal role via controlling and insensitive feeding interactions. Another possible mechanism could be via negative cognitive representations, the same negative cognitive representations that underlie symptoms of psychopathology have been implicated in the development of children's eating problems (Blissett et al., 2005). The following section will review research that has examined links between these cognitive representations, or maternal core beliefs, and child eating problems.

1.9.2.2 Maternal core beliefs

Core beliefs are schema-level cognitions and can be described as unconditional beliefs regarding oneself, others and the world (Waller, Shah, Ohanian, & Elliott, 2001). Unhealthy or maladaptive core beliefs are negative patterns of thinking that affect an individual's cognitive processing, which can ultimately determine behaviour (Young, 1994). Young (1994) proposed that maladaptive core beliefs develop as a result of an interaction between an individual's emotional temperament and negative early interpersonal experiences, ultimately determining how individuals appraise situations, themselves and their relationships with others. Core beliefs relevant to psychopathology have mostly been assessed using the Negative Self-Beliefs Scale (Cooper, Cohen-Tovée, Todd, Wells, & Tovée, 1997) and the Young Schema Questionnaire (Young & Brown, 1994). The Negative Self-Beliefs Scale, however, has been criticized for assessing unhealthy core beliefs as a single dimension as it has been argued that the core beliefs related to psychopathology involve a range of cognitive representations (Waller et al., 2001). The YSQ (Young & Brown, 1994) assesses core beliefs across several dimensions and has been found to be a reliable and well validated measure in both clinical and non-clinical samples (Leung, Waller, & Thomas, 2000; Shah & Waller, 2000). Unhealthy core beliefs have been found to be implicated in a number of disorders including depression, personality disorders and anxiety (Schmidt, Joiner, Young, & Telch, 1995; Young, 1994) and are often regarded as the diathesis of these disorders (Stopa, Thorne, Waters, & Preston, 2001). The development of adult psychopathology has been explained in terms of the initiation and maintenance of unhealthy core beliefs established as a result of early negative life experiences (Young, 1994). Shah and Waller (2000) reported that adults with major depression recall their childhood as being characterised by uncaring and overprotective parenting. Using the YSQ, Shah and Waller found the core beliefs of defectiveness/shame, dependence/incompetence, failure to achieve, vulnerability to harm, self-sacrifice and insufficient self-control to be associated with higher levels of depression leading them to conclude that uncaring parental behaviour may result in maladaptive core beliefs which may lead to susceptibility to depression.

Research investigating the link between maladaptive cognitions and eating psychopathology using the YSQ have implicated the unhealthy core beliefs of shame/defectiveness, insufficient self-control, emotional inhibition and failure to achieve in the development of bulimia (Waller, Ohanian, Meyer, & Osman, 2000). Furthermore, it has been demonstrated that cognitions paramount to Bulimia Nervosa are not entirely centred on food and weight concerns but instead are centred on unhealthy core beliefs relating to low self-worth (Waller et al., 2000). Supporting this theory, Blissett et al. (2005), suggested that a broader range of cognitions rather than the quantity and type of foods consumed are relevant during the interaction between mothers and children with eating problems. For example, mothers who have core beliefs of persistent failure are likely to regard their child's refusal to eat as their own failure at parenting, consequently food fussiness may no longer be regarded as a child health issue but a personal and emotional issue for the mother (Blissett et al., 2005).

Using the YSQ (Young & Brown, 1994), associations have been found between the following maternal unhealthy core beliefs and food fussiness as well as negative maternal feeding strategies in children aged 6 – 74 months: abandonment, emotional deprivation, failure to achieve, defectiveness/shame, entitlement, social isolation, subjugation beliefs, enmeshment and dependence/incompetence (Blissett et al., 2005; Farrow & Blissett, 2006). In explaining these findings, Blissett et al. (2005) proposed that the nature of mothers' unhealthy core beliefs determines how they are likely to interpret and respond to their child's food fussiness. The core beliefs of abandonment, social isolation, defectiveness/shame, enmeshment and dependence/incompetence are specifically centred on the fear of abandonment, inferiority, inadequacy and excessive emotional involvement in the lives of significant others. Food fussiness in children can be viewed as an assertion of independence which may be perceived as threatening for a mother with these core beliefs. Such mothers are likely to feel isolated and powerless when faced with the prospect of independence in significant others resulting in impaired ability to problem solve when faced with eating problems. Emotional deprivation is the belief that one will not receive adequate emotional support from others while subjugation beliefs is the surrendering of control to others due to feelings that one is being coerced. Consequently, mothers with these core beliefs are likely to feel unsupported, detached from relationships with others with feelings of powerlessness and are more likely to use inadequate problem-solving skills in the presence of child eating problems. The core belief of failure to achieve is a feeling of inadequacy and has been explained in terms of perceptions of failure being made worse by child eating problems or perceptions of child eating problems being made worse by feelings of failure. Consequently, mothers with such beliefs are likely to use poor problem-solving skills when addressing the child's eating problem.

Although these findings seem to suggest that maternal unhealthy core beliefs play a causal role in the development of child food fussiness via mothers use of maladaptive feeding strategies, the cross-sectional design prevents causal inferences from being drawn. These findings, however, have established associations between child food fussiness and unhealthy core beliefs in mothers and maladaptive feeding strategies. Many of the maternal core beliefs associated with controlling feeding practices and food fussiness have also been implicated in maternal symptoms of psychopathology (e.g., Shah & Waller, 2000). Therefore, research aimed at developing interventions to address unhealthy core beliefs might be important for improving mother-child interactions during the feeding process which could result in the use of more adaptive feeding practices resulting in less child food fussiness.

1.9.2.3 Maternal Self-esteem

In general, there is a lack of research investigating the contribution of maternal self-esteem in the development of food fussiness. Farrow and Blissett (2006) found low maternal self-esteem to be a longitudinal predictor of infant food fussiness. Low maternal self-esteem has been found to be associated with unhealthy core beliefs of defectiveness/shame, abandonment and failure to achieve (Schmidt, Joiner, Young & Telch, 1995), which has been found to be associated with the excessive use of control during feeding (Blissett et al., 2005). Importantly, interventions resulting in improved self-esteem have found that higher maternal self-esteem is associated with improved interaction during mother-child feeding dyads. For example, Meyeret al. (1994) found an individualized, family-based intervention with preterm infants and their mothers to be associated with increased maternal self-esteem. In this study, standardized questionnaires measuring maternal self-esteem were administered to mothers at baseline. Mothers took part in a family-based intervention which involved providing mothers with information on infant behaviour and communication and on practical aspects of family adaptation to the arrival of a preterm infant and mother. These instructions were found to enhance mother-child feeding interactions characterized by increased maternal sensitivity to infant cues, more physical contact and the use of more vocalizations during feeding resulting in less gagging and grimacing from the child. Post intervention scores showed an improvement in maternal self-esteem scores. Given the association between maternal self-esteem, unhealthy core beliefs and maternal depression, more research investigating its unique contribution in the development of food fussiness is warranted.

1.9.2.4 Summary

The above literature has shown that there is evidence that child temperament, maternal mental health, low maternal self-esteem and unhealthy core beliefs are important factors in the development of food fussiness. Research bringing together these child and parent factors in the development of food fussiness would be useful in determining the unique contribution of child and parent factors to the development of food fussiness. Such research will be able to determine if both child and parent factors are equally important in the development of food fussiness or identify the most important risk factor(s) in the development of food fussiness and reveal interaction relationships. The following section will therefore discuss studies that have examined child and maternal characteristics together in the development of food fussiness.

1.10 Relative Influence of child temperament and maternal characteristics on food fussiness

Farrow and Blissett (2006) prospectively investigated the relationship between maternal psychopathologic symptoms, maternal core beliefs, maternal self-esteem, infant temperament and food fussiness during pregnancy and 6 months postpartum. Infant food fussiness was described as disliked and refused foods during weaning. It was found that maternal reports of infant food fussiness were predicted by higher levels of emotional deprivation and entitlement core beliefs and lower levels of self-sacrifice and enmeshment core beliefs during pregnancy. In addition, lower maternal self-esteem and difficult infant temperament was found to predict food fussiness. However maternal symptoms of depression and anxiety were not found to be predictors of food fussiness, failing to support the link observed in previously described studies (e.g., Blissett et al., 2007; Coulthard & Harris, 2003; McDermott et al., 2008). This study however examined relationships between maternal and child variables with food fussiness in six-month-old infants; an age where food fussiness does not usually pose a problem to parents. Using a longitudinal design, Hafstad et al. (2013) examined the relationship between maternal and child factors with food fussiness in early childhood, a period associated with a food fussiness prevalence of 40-50% (e.g., Carruth et al., 2004; Hafstad et al., 2013). In this study, 913 Norwegian families were recruited when their children were 18 months old (T1) who were subsequently followed up when the children were 2.5 years old (T2) and 4.5 years old (T3). To assess food fussiness, parents completed the Behaviour Checklist (Richman & Graham, 1971) at TI, T2 and T3 while childhood temperament was assessed at T1 using the EAS Temperament survey for children (Buss & Plomin, 1984). Maternal depression and anxiety were assessed at T1, T2 and T3. Maternal core beliefs however were not measured in this study. Hafstad et al. (2013) found child emotionality and maternal depression to be significant longitudinal predictors of food fussiness in children aged 18 months to 4.5 years. The authors explained these findings in terms of the difficult interaction between the child and parents during mealtimes arising from the child's emotional temperament which could influence the atmosphere during mealtimes and the child's eating behaviour. In both studies reviewed above, food fussiness was assessed using parent-self-report which can be subjective and produce biased responses. Objective measures of children's eating may provide a more objective assessment of food fussiness and help validate parent-report. In addition, both studies have a notable methodological limitation in that the order that mothers completed the self-report questionnaires was not specified. It is possible that mothers may have completed the child food fussiness questionnaire before the child temperament and maternal psychopathologic questionnaires. This may have confounded mothers' responses as it is possible that mothers may have equated their child's food fussiness with being difficult when responding on the child temperament questionnaire. Likewise, it is also possible that their child's food fussiness may have elicited negative emotions as a result of concerns about the child's eating pattern which may have influenced responses regarding maternal psychopathology.

Research investigating both maternal and child characteristics as risk factors for the development of food fussiness are limited and have produced contradictory results. Farrow and Blissett (2006) found child temperament, unhealthy maternal core beliefs and low self-esteem to be predictive of food fussiness but maternal symptoms of depression and anxiety were not implicated. Hafstad et al. (2013) did not measure maternal core beliefs and maternal self-esteem but found child temperament and maternal symptoms of depression and anxiety to be longitudinal predictors of food fussiness. In addition, there are methodological limitations inherent in both studies. Future research addressing these limitations would facilitate the identification of the most important risk factors for food fussiness.

1.11 Influence of Parenting on Food Fussiness.

Parents play an important role in influencing children's eating behaviour particularly in early childhood where parents act as providers, enforcers and role models through the foods they make available, the feeding practices they employ as well as the quality of the interactions they have with their child during mealtimes (Clark, Goyder, Bissell, Blank, & Peters, 2007; Savage et al., 2008; Van Der Horst & Sleddens, 2017). The dietary pattern associated with food fussiness is understandably likely to cause parental concern regarding their child's physical and cognitive development. It is also likely to influence the types of foods parents offer and to result in conflict and struggles between parents and their fussy children during mealtimes. The following section will discuss the impact of parenting on food fussiness.

1.11.1 Food Fussiness and Parent's Feeding Goals

Research has highlighted the positive and negative outcomes of parental feeding behaviours on child eating behaviour (e.g., Faith, Scanlon, Birch, Francis, & Sherry, 2004; Ventura, 2008; Wardle et al., 2005). Parent feeding goals are the motivations for parental feeding behaviours and have an influence on the choices of foods that parents provide for their children as well as on the strategies that parents use to influence child eating (Moore, Tapper, & Murphy, 2010). Parent feeding goals can either be health-oriented or non-health oriented. Health oriented feeding goals are mainly focused on promoting optimal nutrition e.g. Gibson, Wardle, and Watts (1998) found that mothers who reported disease prevention as an important feeding goal tended to ensure lower percentage fat intake and increased fruit consumption in their children compared to mothers who rated disease prevention as a feeding goal of low importance. Non-health-oriented feeding goals focus on factors such as food cost, speed of preparation, child's mood and food familiarity (Carnell, Cooke, Cheng, Robbins, & Wardle, 2011; Moore et al., 2010; Sealy, 2010). Research suggests that child feeding problems including food fussiness influence parents' feeding goals. Moore et al. (2010) found that the long-term feeding goal of mothers of "good eaters" was ensuring that their child consumed a varied, well balanced and healthy diet. In contrast, mothers of "problem eaters" (e.g. fussy eaters) were concerned about short term feeding goals that applied on a meal to meal basis typically with the aim of allowing their child access to anything they were willing to eat. Moore et al. (2010) found that mothers of "problem eaters" no longer viewed providing a healthy balanced diet as paramount but were mainly concerned with preventing hunger and distress in their children, often giving in to their children's demands of preferred foods. Similarly Hendy, Williams, Riegel, and Paul (2010) found that parents of fussy eaters who were concerned with their child's weight status often stopped offering disliked foods and usually resorted to the preparation of "special meals" which consisted of their fussy children's limited variety of high calorie favourite foods. Parents concern about the effect of a nutritionally inadequate diet on their child's physical and cognitive development has recently been highlighted by the launch of Paediasure shakes in 2013 - a food supplement drink containing essential nutrients to support children in the food fussiness stage. Previous research, however, has found that children need up to at least 10 exposures to new foods across time to foster acceptance (Birch, McPhee, Shoba, Pirok, & Steinberg, 1987; Wardle, Herrera, Cooke, & Gibson, 2003). Consequently, by giving in to their children's demands for preferred foods, parents are inadvertently reinforcing their children's food fussiness by denying them the opportunity to learn to enjoy new foods, resulting in a limited diet with its associated health risks (Hendy et al., 2010).

1.11.2 Food Fussiness and Parent's Feeding Practices

Parents are often concerned about the implications that food fussiness may have on their child's health and development and may try different specific feeding practices to encourage and curb the consumption of certain foods (Mitchell et al., 2013). Parental feeding practices refer to the various strategies that parents use in an attempt to alter and maintain their child's eating behaviour (Ventura & Birch, 2008). Research indicates that modelling, exposure, pressuring children to eat, restriction of food intake and use of rewards/incentives are feeding practices widely used by parents. The following section will describe and discuss each of these parental feeding practices.

1.11.2.1 Pressure to Eat

Parents of fussy eaters have been reported to use pressure to encourage eating in these children (Fisher et al., 2002; Galloway et al., 2005). Pressure to eat is an attempt by the parent to control the type and amount of food the child consumes which usually involves the parent pushing the child to eat more or increase their intake of healthy foods (Birch, Fisher, & Davison, 2003; Haycraft & Blissett, 2008). The use of pressure to eat includes practices such as verbal prompts in which parents may use neutral verbal prompts (e.g. "Don't forget to eat your peas") or demanding and threatening verbal prompts (e.g. "You must eat when I say you eat") to get the child to eat (Orrell-Valente et al., 2007). Pressure to eat also extends to the use of physical prompts where parents may attempt to force feed the child (Haycraft & Blissett, 2008). Parents of fussy eaters have been observed to use pressure on their children during feeding mainly to increase food consumption and improve dietary variety, often beyond what the child is willing to consume (Antoniou et al., 2016; Carruth et al., 1998; Farrow & Blissett, 2008; Galloway et al., 2005; Ventura & Birch, 2008).

Research investigating the effects of parents' use of pressure to eat on child eating behaviour has produced conflicting results. Pressure to eat in the form of neutral verbal persuasion has been observed to be associated with compliance in children, resulting in increased consumption of the target food (Orrell-Valente et al., 2007). A few studies, however, have reported that the strategy of pressurizing children to eat is counter-productive and has maladaptive consequences on children's eating behaviour. For instance, Fisher et al. (2002) found a negative relationship between pressure to eat and measures of dietary variety and quality. In this study, five-year-old girls who received more pressure to eat from their parents tended to have lower fruit, vegetable and micronutrient intakes. Increased pressure to eat healthy foods such as fruits and vegetables has also been found to be associated with increased consumption of unhealthy savoury snack foods (Campbell, Crawford, & Ball, 2006). Further, parent use of pressure to eat in childhood has also been found to predict higher levels of disordered eating behaviours associated with Bulimia Nervosa in young adulthood (Ellis, Galloway, Webb, Martz, & Farrow, 2016).

Higher levels of parental use of pressure have been found to be associated with higher levels of food fussiness and lower levels of energy intake. Cross sectional research provide evidence linking parents' use of pressure to food fussiness. For example, Webber, Hill, Cooke, Carnell, and Wardle (2010) found a positive association between maternal use of pressure and food fussiness in a sample of children aged 7-9 years. This finding was also replicated in a sample of children aged four years (Jansen et al., 2012). Increased pressure to eat has also been found to be related to behaviours that are typical of food fussiness such as prolonged meal duration and high levels of dietary restraint (e.g., Carper, Orlet Fisher, & Birch, 2000; Klesges et al., 1983). However, it is not possible to make causal inferences from cross sectional data and it is also plausible that parents' concerns about children's food fussiness and its related behaviours may result in parent's use of pressure. In a longitudinal study, Galloway et al. (2005) found that children who were pressured to eat more by their parents at age seven had greater food fussiness at age nine, resulting in the consumption of fewer fruits and vegetables and limited dietary variety. This finding suggests that parents use of pressure is a risk factor for child food fussiness. Furthermore, a retrospective study revealed that some food dislikes and rejection in adults are linked to their early childhood memories of being pressured to eat specific foods (Batsell, Brown, Ansfield, & Paschall, 2002). This study however is limited by its retrospective design which is subject to recall bias. In addition, the authors acknowledge that failure to concurrently enquire about food dislikes and rejection that were not accompanied by memories of being pressured prevents any evaluations being made about whether the use of pressure produces stronger food rejection.

Research investigating the effects of parents' use of pressure on food fussiness seems to infer that the use of pressure may play a causal role in the development of food fussiness. As previously mentioned earlier, it is however possible that some parents may use pressure in response to their child's food fussiness. A few studies have found the use of differential feeding practices amongst parents is dependent on the child's eating behaviour. These studies have used twin designs which control for genetic and environmental influences and provide an opportunity for researchers to investigate parents' responses to differential child characteristics. For example, Farrow, Galloway, and Fraser (2009) found that parents of 3-6-year-old twins reported using greater levels of pressure when feeding the fussier twin in comparison to their sibling. More recently, Harris, Fildes, Mallan, and Llewellyn (2016) found that mothers varied their levels of the use of pressure depending on the severity of food fussiness, mothers of pairs of 16-month-old twins reported more use of pressure and food rewards when feeding the fussier twin. These sibling studies have found that parents reported using more pressure to eat in response to children who were fussier indicating that parents use certain feeding strategies dependent on the presence of food fussiness and provide evidence that parents feeding practices may be a consequence of child food fussiness. Given this, it is important to be cautious when interpreting cross-sectional research. Indeed, a bidirectional relationship between parents' use of pressure and food fussiness may exist. For example, in a longitudinal study, Jansen et al. (2017) found that greater food fussiness in children aged 1.5 years was associated with higher levels of parental pressure when the child was four years old and a reverse association of higher levels of parental pressure at age four with greater food fussiness at age six.

1.11.2.2 Restriction of Intake

Restriction of food intake is another strategy used by parents of fussy eaters and involves an attempt to control their children's diet by restricting their access to unhealthy foods (Birch et al., 2001). It has been suggested that restriction prevents adequate self-control in children by increasing their desire to consume restricted foods when available even in the absence of hunger (Birch & Fisher, 2000). Evidence suggests that the use of restriction to limit children's access to certain foods often results in a preference for the restricted food (Fisher & Birch, 1999). Similarly, children have been observed to increase their fruit consumption in response to reduced parental use of restriction (Gribble, Falciglia, Davis, & Couch, 2003). A positive association has also been found between greater child food fussiness and higher parental use of restriction of intake (Jansen et al., 2012). Contradictory effects of restriction on children's food preferences were provided by Gubbels et al. (2009) who reported that parental use of restriction of unhealthy food items in their 2-year-old children resulted in less consumption of the restricted food item and higher consumption of the healthy options.

Mixed findings on the influence of the use of restriction on children's eating behaviour has been attributed to the complex nature of restriction which may not been captured in its entirety by most commonly used measures (Ogden, Reynolds, & Smith, 2006). Research has distinguished between overt and covert restriction (Ogden et al., 2006). Overt restriction involves limiting a child's intake of unhealthy foods in a way that can be discerned by the child (Ogden et al., 2006). This involves parents being firm and directly instructing their children on what foods they can eat (which may involve restricting access to their favourite snack), when to eat and how much they can eat. It has been reported that parents' use of overt restriction results in an increase in children's requests for the restricted food (Birch et al., 2003). Overt restriction has also been associated with increased consumption of the restricted food when it is made available (Ventura & Birch, 2008). Covert restriction, on the other hand, involves limiting unhealthy foods in a manner undetected by the child for example parents taking proactive measures to determine the foods their children become exposed to e.g. refraining from buying unhealthy food from supermarkets, parents avoiding consuming unhealthy foods in the presence of children or avoiding taking children to restaurants/cafes that sell unhealthy foods (Ogden et al., 2006). Covert restriction may not be associated with increased request and consumption of restricted food (Ogden et al., 2006).

As described above for pressure to eat, parents may vary their use of restriction in response to their child's food fussiness. For example, (Farrow et al., 2009) found that parents of 3-6-year-old twins reported using greater levels of restriction when feeding the fussier twin in comparison to their sibling.

Many of the studies investigating the relationship between parents' use of pressure and restriction with food fussiness have relied on parent report measures to assess parent's use of feeding practices. Although parents have been shown to be accurate and reliable sources of feeding interactions (e.g., Cooper et al., 2004; Whelan & Cooper, 2000), the use of parent-report measures have been found to promote social desirable responses, under-reporting of negative interactions and parents limited awareness of their own behaviour (e.g., Carnell & Wardle, 2007; Grotevant & Carlson, 1989; Melby et al., 1998; Nisbett & Wilson, 1977; Stansbury, Haley, Lee, & Brophy-Herb, 2012). Independent observations of parents' use of pressure and restrictive practices during mealtimes will allow a thorough examination of these feeding practices and endorse parent's accuracy at reporting on their use of these feeding practices.

1.11.2.3 Use of Rewards/ Incentives

Parents often try and persuade children to accept disliked unfamiliar foods by offering them rewards and incentives. This feeding practice is known as a means- end contingency and stems from the method of reinforcement in which a preferred stimulus is used as a reinforcer for a less preferred stimulus (Skinner, 1938). It has been suggested that in order for rewards to be effective, it is important that they are highly desirable and therefore potent reinforcers and that they convey to the child that they are for behaviour that is both enjoyable and of high status (Cameron, 2001).

Rewards may either be tangible food rewards e.g. offering children their favourite food if they eat disliked and unfamiliar foods and tangible non- food rewards (e.g. stickers, toys, etc.) as well as social rewards such as praise. The use of rewards as a strategy to increase food acceptance in fussy children has produced mixed results with some research citing negative effects. Birch et al. (1984) found that although the use of praise and tangible rewards increased children's liking of an unfamiliar drink in the short term, over a longer term, there was a negative shift in children's preference for the unfamiliar drink. It has also been found that using a sweet dessert as a reward for the consumption of broccoli resulted in an increase in preference for the consumption of the sweet dessert and a decline in liking for the broccoli in a sample of children aged 3-5 years (Birch et al., 1984). A similar trend was observed by Newman and Taylor (1992) who found an increase in preference for snacks which served as a reward and a decrease in preference for snacks that were to be consumed before obtaining a reward in a sample of children aged 4 -7 years. This effect is known as the "over justification effect" for which a cognitive explanation has been provided which suggests that if children feel they have to be rewarded to eat a particular food, then the food must taste bad and they must not like the (Newman & Taylor, 1992; Newman & Layton, 1984). These studies seem to indicate that the use of reward as a feeding practice is counterproductive and could exacerbate food fussiness as it could result in a preference for the food used as a reward and a decline in preference for the rewarded food.

Other studies however have cited positive effects of the use of rewards in increasing food acceptance. For example, a few studies have found an increase in children’s intake of healthy food in response to the use of praise as a reward (Stark, Collins, Osnes, & Stokes, 1986; Vereecken, Keukelier, & Maes, 2004). Other studies have found tangible non-food rewards such as stickers, toys, caps etc. to increase children’s fruit and vegetable intake even after the rewards were withdrawn (Hendy, Williams, & Camise, 2005; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004; Wardle et al., 2003). It has been suggested that non-food rewards such as stickers, praise and toys may convey positive messages about the child’s achievement and competence (Cameron, Banko & Pierce, 2001). However, studies that have found positive effects of tangible non-food rewards on food intake combined the use of tangible non-food rewards with exposure and peer modelling making it difficult to determine the unique contribution of rewards in increasing children’s food intake.

1.11.2.4 Modelling

Modelling has been shown to be a powerful predictor of food consumption in children who learn not only by experience but by observing others (Savage et al., 2008). Several studies have found that children increase their acceptance of particular foods when modelling the consumption of food by parents, peers and teachers (Greenhalgh et al., 2009). Parental modelling in which a fussy eater watches his/ her parent consume an unfamiliar food has been shown to be more effective in increasing food acceptance than simply offering the child the unfamiliar food (Addessi, Galloway, Visalberghi, & Birch, 2005; Harper & Karen, 1975). Gibson et al. (1998) found a strong relationship between parent and child fruit and vegetable consumption as parents’ own eating behaviour influenced the eating behaviour of their children. Similarly, Lumeng and Burke (2006) observed that 3-6-year olds chose a disliked food if their mothers expressed their liking for the food on absolute terms (i.e. “I like this one, mmm very yummy!”). In addition, parental consumption of fruits and vegetables has been found to be the strongest parental predictor in child fruit and vegetable consumption (Coulthard & Blissett, 2009). However, while this effect could be attributed to modelling, another possible explanation could be that parents who consume fruits and vegetables make them more available in the home therefore repeatedly exposing their children to fruits and vegetables which could also account for increased consumption.

Although most research has highlighted the positive outcomes regarding children’s eating behaviour associated with parental modelling, a few studies have reported some negative outcomes. Brown and Ogden (2004) found children increased their intake of unhealthy snacks by modelling their parents consuming these foods. Parental modelling has also been found to play a role in the transmission of unhealthy eating attitudes from parents to children. Cutting, Fisher, Grimm-Thomas, and Birch (1999) found that 3-6-year-old girls who observed dietary disinhibition and restraint in their mothers adopted similar eating behaviours.

Researchers have also investigated the role of significant others besides parents in the child’s social context that could influence their eating behaviour. Peer modelling has been found to have significant implications on what fussy children accept and reject. For instance, Cullen et al. (2001) reported that older children’s fruit and vegetable consumption is not only related to parental modelling but also to the beliefs their peers hold about the consumption of such foods. Several studies have shown that children will pick a food to eat after they have witnessed other children pick the same food (Dovey et al., 2008; Greer, Dorow, Williams, McCorkle, & Asnes, 1991; Hendy, 2002). Greenhalgh et al. (2009) found that 3-7-year olds are more likely to eat an unfamiliar food if they see a peer modelling consumption positively, however, there was less consumption of the unfamiliar foods in children exposed to negative peer modelling. A few studies have investigated the attributes of effective peer models and reported that peers who are the same age or older than the target child exert more influence on food preference than younger peers. In a very early study, Duncker, (1938) found that younger children showed liking for a previously disliked food after observing consumption in older children, however the same effect was not found when older children observed consumption in younger children. Similarly, Birch, Zimmerman, and Hind (1980) found that older children were more influential in changing younger children's preference ratings and consumption of vegetables. Further, same age and older peers and not younger peers were found to influence a target child's preference for fruits (Brody & Stoneman, 2018).

Research on the effectiveness of teacher modelling in influencing children's food preferences has found that enthusiastic modelling where foods are presented to children with great enthusiasm e.g. (Mmm! I love this vegetable, tastes nice) followed by cheering and clapping when the children followed the teachers' example is associated with increased consumption of previously disliked foods in children (Highberger & Carothers, 1977). The preferences of competing peer models however have been found to counteract the effectiveness of enthusiastic teacher modelling (Hendy & Raudenbush, 2000).

1.11.2.5 Exposure

Exposing children to a variety of foods is a feeding strategy that has been found to increase food acceptance (Birch & Marlin, 1982; Wardle et al., 2003). Prior exposure to a particular food is a strong predictor of subsequent liking and acceptance. This is known as the mere exposure effect (Zajonc, 1968) which posits that the outcome of familiarisation with a stimulus is a positive attitude towards the particular stimulus. Evidence suggests that early taste exposure begins in utero and influences a child's preference and acceptance of particular tastes post-natally (Hauser, Chitayat, Berns, Braver, & Muhlbauer, 1985). By the third trimester, the taste and olfactory systems are functional, and the foetus is capable of inhaling and swallowing the surrounding amniotic fluid which has nuances of strong aromas from the mother's diet such as garlic or cumin (Browne, 2008; Mennella, Johnson, & Beauchamp, 1995) few studies have found that prior exposure in utero to various aromas and flavours influences a child's subsequent liking for the particular taste. For example, Schaal (2000) found that three-hour old neonates who were exposed to anise flavour in utero from their mother's diet made fewer negative facial expressions and longer head orientation towards presented anise scent in comparison to neonates who had no prior exposure to anise in the womb. As previously discussed earlier, Mennella et al. (2001) found that exposing breastfed infants to carrot flavour transmitted through the mother's breastmilk from her diet resulted in the acceptance of a carrot flavoured cereal during weaning.

Repeated exposure has been found to modify liking for particular foods over time. Beauchamp and Moran (1982) found that although infants are born with an innate preference for sweet foods, repeated exposure to sugar water during their first six months resulted in greater liking and consumption and in a decline in acceptance in infants that were not exposed over the first six months. Repeatedly exposing children to disliked fruits and vegetables has been found to result in greater liking and acceptance. As discussed previously, it has been suggested that the number of exposures needed to enhance children's liking and acceptance of a novel/ disliked food increases with child age. Infants require just a few exposures (Maier, Chabanet, Schaal, Issanchou, & Leathwood, 2007), two year olds require 5- 10 repeated exposures, (Birch & Marlin, 1982; Birch et al., 1987) while children aged 3-4 years need as many as 15 repeated exposures (Sullivan & Birch, 1990). However, a few studies have observed that many parents fail to reach these required thresholds accepting initial food rejection as the child's genuine dislike of the offered foods (Cooke et al., 2004; Skinner, Carruth, Bounds, Ziegler & Reidy, 2002). It has been reported that 80% of caregivers are willing to only offer their child a novel food three or four times before deciding that the child does not like the food based on the child's food refusal behaviours (Carruth et al., 2004). Wardle et al. (2003) found that eight sessions of exposing children aged 5-7 years to raw red pepper shifted children's liking from a margin between liking and disliking to maximum liking as indicated on a five point "faces" scale and resulted in increased intake.

1.11.3 Food Fussiness and Parent-Child Interactions

Parent- child interaction has been deemed vital for adequate child development (Chatoor et al., 2000) with several studies citing parental sensitivity, involvement, warmth and responsiveness as important factors for optimal child and adolescent well-being (Ainsworth, Blehar, & Waters, 1978; Maccoby, Martin, Mussen, & Hetherington, 1983). Within the feeding process, it has been suggested that the quality of parent-child interactions may be critical to the development of healthy and unhealthy child eating behaviours (Skouteris et al., 2012). Parent-child interactions imbued with parental warmth, sensitivity, praise, modelling and positive comments during mealtimes have been found to be associated with healthy eating behaviours. For example, Patrick, Nicklas, Hughes, and Morales (2005) found that an authoritative parent feeding style characterised by higher levels of warmth, praise and parental responsibility was positively associated with the consumption of dairy, fruit and vegetables in a sample of 3-5-year-old children and their parents. By contrast, mother-child dyads ingrained with insensitivity, aversiveness and negativity have been found to be related to child feeding problems. For example, Chatoor, Egan, Getson, Menvielle, and O'donnell (1988) compared mother-child feeding interactions in a group of infants diagnosed with infantile anorexia nervosa and a group of matched controls. Interactions between mothers and their children were videotaped. It was observed that there were more dyadic conflicts and struggles as well as more maternal intrusiveness, and less maternal responsiveness to the infant's needs in the feeding disordered group in comparison to the control group. Likewise, some of the controlling feeding practices reviewed in the preceding literature would lead to difficult parent-child feeding interactions. Pressuring and restrictive feeding practices would lead to negative parent-child interactions characterised by struggles and conflicts during mealtimes. Studies investigating parent-child interactions during mealtimes seem to suggest a unidirectional influence of the parent on the child during the feeding process, however as feeding is a bidirectional process (Cabanac, 1985), it is possible that children's behaviours are also likely to impact on parent-child interactions during mealtimes. Child food fussiness has been shown in several studies to be associated with disruptive mealtime behaviours e.g. playing with foods offered rather than eating, spitting out food, screaming and temper outbursts (Carruth & Skinner, 2013; Timimi et al., 1997). These disruptive behaviours displayed by fussy eaters during mealtimes have been found to influence parent-child interactions during feeding resulting in parents' use of controlling feeding practices associated with increased food fussiness. For example, in an observational study, Sanders, Patel, Le Grice, and Shepherd (1993) found a positive association between disruptive behaviours displayed by fussy eaters such as playing with food and difficult mother-child interaction during mealtimes characterised by aversive negative prompts, negative instructions and negative eating comments.

1.11.4 Summary

Parents are pivotal in shaping the diets of the children through the foods they provide, the quality of the interactions with their child and the feeding strategies they use during mealtimes. Child food fussiness however has been found to act as a barrier to optimal parenting limiting the choices of foods parents provide and encouraging the use of aversive feeding practices that intensify food fussiness. Parent's feeding goals are influenced by their child's food fussiness whereby parents are more concerned with the prevention of hunger by allowing their children consume foods that they are willing to eat rather than ensuring a healthy varied diet. "Giving in" to children's demands ultimately reinforces food fussiness as it hinders children from being repeatedly exposed to new foods to encourage acceptance. Parents' concern for the consequences of food fussiness on their child's health may result in the use of several feeding practices to encourage food consumption in their children. While feeding practices such as modelling and exposure have been found to encourage food acceptance, controlling feeding practices such as parents' use of pressure, restriction and food rewards have been found to be associated with increased food fussiness. Child food fussiness has been found to be associated with disruptive mealtime behaviours which influence parent-feeding interactions during feeding resulting in insensitive and negative parent-child feeding dyads which could further exacerbate food fussiness.

1.12 Food Fussiness and Sensory Sensitivity

The preceding literature has reviewed studies that have examined child and parent factors in relation to food fussiness. These studies have highlighted child temperament, maternal psychopathology, maternal core beliefs and controlling feeding practices as significant correlates and risk factors for the development of child food fussiness. Another factor that has been found to contribute to food fussiness is the child's sensory processing. The following section will discuss research that has investigated associations between sensory processing and food fussiness.

The act of eating involves processing sensory information across several sensory modalities such as taste, smell, vision and touch (Rolls, Rowe, & Rolls, 1982). The sensory properties of food have been found to be a major determinant of food preferences in children, taste, texture and the visual properties of food have been observed to influence liking (Baxter, Jack, & Schroder, 1998; Blossfeld, Collins, Kiely, & Delahunty, 2007; Russell & Worsley, 2013). It is well established that there are individual differences in perception and responses to sensory information (Dunn, 1997). Sensory sensitivity has been defined as individual differences in detection and reactions to sensory information across various sensory domains including information from touch, vision, smell and taste senses (Dunn, 1997). In the literature, sensory sensitivity has been described using several terms. A few studies have used the term sensory over-reactivity which has been defined as an adverse response to sensory stimuli (e.g., Liss, Saulnier, Fein, & Kinsbourne, 2006; Tavassoli et al., 2018). Some have used the term sensory hyperreactivity which is also defined as an adverse response to sensory stimuli (e.g., Siper, Kolevzon, Wang, Buxbaum, & Tavassoli, 2017). Others have used the term sensory over-responsiveness which is defined as negative responses to sensory stimuli characterised by the perception of sensations as aversive, uncomfortable and/or painful (Mazurek et al., 2013; Schoen, Miller, & Flanagan, 2018; Schoen, Miller, & Green, 2008). Despite the differences in terminology, these terms all describe heightened reaction to sensory stimuli. Throughout this thesis, sensory sensitivity will be referred to using the term sensory hyperreactivity.

In the context of food, it has been suggested that highly hyperreactive individuals may have a lower threshold for detecting sensory information, meaning that they are more likely to notice subtle aspects of the sensory properties of food, and as a result, may be more likely to reject foods (Coulthard & Blissett, 2009).

Genetic variation in sensory hyperreactivity has been found to influence individual food preferences especially for fruits and vegetables. It has been reported that there are genetic variations in taste perception which may contribute to the development of children's food preferences (Duffy & Bartoshuk, 2000). The variation in response to the taste perception of compound 6-n-propylthiouracil (PROP) present in many bitter tasting vegetables is genetically determined (Bell & Tepper, 2006). It has been found that 50% of the population are "medium tasters" and perceive PROP to be moderately bitter, 20% are highly sensitive "supertasters" who find PROP intensely bitter, while 30% are "non-tasters" who find PROP tasteless (Hayes, Bartoshuk, Kidd, & Duffy, 2008; Tepper, 1998). It has been suggested that supertasters struggle to include bitter tasting food items in their diet (Kaminski, Henderson, & Drewnowski, 2000). PROP sensitivity in children has been found to be associated with the rejection of bitter tasting vegetables such as broccoli and spinach (Bell & Tepper, 2006; Keller, Steinmann, Nurse, & Tepper, 2002; Turnbull & Matisoo-smith, 2002) and lower acceptance of strong cheeses (Anliker, Bartoshuk, Ferris, & Hooks, 1991).

In addition to hyperreactivity to specific tastes, tactile hyperreactivity may also influence food preferences and fussiness. Tactile hyperreactivity refers to individual differences in tactile perception and affective responses to tactile stimulation (Cascio et al., 2008; Shula, Haim, Avraham, & Marsha, 2008). Children who have greater tactile hyperreactivity show aversion to the feel of sand and grass and appear to be more sensitive to oral touch and to the textures of food (Dunn, 1997). It is possible that heightened hyperreactivity to tactile stimuli may explain why some children discriminate between foods based on their textures. In support of this idea, Smith, Roux, Naidoo, and Venter (2005) provided evidence of an association between clinically diagnosed tactile hyperreactive children with the rejection of vegetables in general and with the rejection of vegetables based on texture. In this study, Smith et al.(2005)

found tactile defensive children to have a lower preference for vegetables in comparison to non-tactile defensive children. In addition, tactile defensive children rejected specific textures of vegetables to a higher degree than non-tactile defensive children. Textures rejected by tactile defensive children included fresh and crispy cooked vegetables, soft cooked vegetables, pureed vegetable soup and soup containing vegetable pieces. Further, adult fussy eaters have been found to reject foods based on their texture, rejecting foods with a slimy texture in comparison to non-fussy eaters (Kauer et al., 2015).

A few studies have examined the relationship between tactile hyperreactivity and food fussiness in non-clinical populations. Coulthard and Blissett (2009) found that children aged 2-5 years with higher levels of tactile hyperreactivity consumed less fruits and vegetables and were reluctant to try novel foods. However, this study did not capture food fussiness in its entirety as it only measured tactile responses to new foods providing no information on tactile responses to familiar foods. Farrow and Coulthard (2012) found an association between greater food fussiness and higher levels of tactile sensitivity in a sample of children aged 5-10 years. However, due to the cross-sectional design of these studies, causal inferences between tactile hyperreactivity and food fussiness cannot be drawn. These studies are limited by their reliance on parent report questionnaires which may have been subject to biased responses whereby parents who are overly concerned may be likely to overly report food fussiness and tactile hyperreactivity in their children (Nederkoorn, Jansen, & Havermans, 2015). Studies using behavioural measures of tactile hyperreactivity and food fussiness are more likely to provide a more thorough examination of the relationship between these two variables.

Research has begun to address this limitation by including behavioural measures of food fussiness and tactile hyperreactivity in addition to parent-report. Nederkoorn, Jansen, and Havermans (2015) obtained behavioural measures as well as parent report of tactile hyperreactivity and food fussiness in children aged 4-10 years to test their theory that children with a higher hyperreactivity to touch are more likely to dislike the feel of particular foods in their mouths and to reject these foods. Behavioural measures of tactile hyperreactivity were found to be associated with food fussiness, higher tactile hyperreactivity was associated with increased food fussiness indexed by the refusal to taste presented food items. This association was found in younger children aged 4 -7.5 years but not in older children >7.5 years. Szczesniak (2002) suggests that this age difference may be explained by the fact that tactile qualities of food are more important in younger children as these children have an underdeveloped dental structure making it difficult to manipulate foods of different textures in their mouth. Consequently, younger children may have an adverse reaction to the experiences of certain textures in their mouths and are likely to be very selective in their food choices. Similarly, Werthmann et al. (2015) investigated whether texture manipulation of a well-known and well-liked smooth yoghurt affected food acceptance in a sample of children aged 32-48 months. The texture of the yoghurt was manipulated by adding small and large raspberry pieces. Behavioural measure of food acceptance indexed by the number of spoons of yoghurt consumed was viewed as an indication of food fussiness. It was found that texture manipulation had an adverse effect on food acceptance. Recently, it has been found that tactile exposure to a non-food texture, whereby children aged 3-10 were exposed to the texture of odourless and colourless jelly increased the acceptance of desserts with the same texture (Nederkoorn, Theiβen, Tummers, & Roefs, 2018).

A few cross-sectional studies have also investigated the association between food fussiness and sensory hyperreactivity in other sensory domains in addition to tactile hyperreactivity. For example, Farrow and Coulthard (2012) proposed that children who are more sensory hyperreactive have lower thresholds for detecting sensory information and therefore able to detect subtle changes in the sensory properties of food. Farrow and Coulthard (2012) assessed children's responses to sensory stimuli across tactile, visual, olfactory, auditory and taste sensory domains. It was found that in addition to higher tactile hyperreactivity, higher taste and olfactory hyperreactivity were also associated with parental perception of food fussiness. However, no association was found between food fussiness and visual/auditory hyperreactivity. Similarly, Coulthard and Blissett (2009) found that in addition to higher tactile hyperreactivity, higher taste and olfactory hyperreactivity was associated with the rejection of novel foods and with lower fruit and vegetable consumption and also observed no effect for visual and auditory hyperreactivity. Further, Zucker et al. (2015) found greater levels of food fussiness to be associated with enhanced hyperreactivity to food texture, smell, visual and motion. Further, parents who described their children as fussy eaters reported extreme hypersensitivity to texture and smell (Boquin, Moskowitz, Donovan, & Lee, 2014). It should be noted that these studies have only established relationships between sensory hyperreactivity and food fussiness and provide no evidence of any causal relationship between sensory hyperreactivity and food fussiness due to their cross -sectional design. Sensory hyperreactivity has also been found to be a longitudinal predictor of food fussiness. Steinsbekk, , et al. (2017) found that children who were higher on sensory hyperreactivity at age four years were at a higher risk of becoming fussy eaters at age six years in comparison to less sensory hyperreactive children.

As in studies that examined relationships between food fussiness and tactile hyperreactivity, these studies are also limited by their use of parent report to assess children's sensory processing across these several domains, further research including behavioural measures of children's sensory processing will provide a better understanding of the food fussiness and sensory hyperreactivity relationship.

1.13 Interventions for Food fussiness

Due to the health concerns and negative impact on the family environment, in some situation's parents experiencing difficulties with their children's fussiness seek help from health professionals. It has been suggested that parents of children with eating problems have inaccurate beliefs about nutrition or poor knowledge about nutritional requirements as well as ineffective feeding practices (Chatoor, Hirsch, Ganiban, Persinger, & Hamburger, 1998). Consequently, the interventions recommended to parents are mainly educational and typically comprise the provision of educational literature through the use of leaflets or educational group programmes (Mitchell et al., 2013). The following section will discuss the various recommendations made by health professionals and research led evidence-based interventions to address child food fussiness.

1.13.1 General Advice and Information

The dissemination of leaflets to parents of fussy children by health professionals is common and has been found to be time effective (Hunter, 2005). These leaflets usually contain general advice and suggestions to increase fussy children's acceptance of fruit and vegetables and increase diet variety (e.g. NELFT food fussiness leaflet). However, the use of leaflets has produced mixed results. The "Mealtime Magic" Intervention (Inglis, Docherty, & Pryke, 2010) made use of leaflets in combination with verbal instructions and was found to be effective. This intervention involved health professionals in Worcestershire (UK) distributing leaflets to parents of children aged under five who had consulted primary care services with concerns about their children's eating behaviour. The leaflets focused on three important messages (1) parents should offer unfamiliar foods up to 20 times to familiarise their children with them (2) healthier diets should consist of a variety of different foods and not limited to a few of the child's favourite foods and (3) parents should desist from telling their children to eat everything on their plate. Up to 50 % of parents reported that the leaflets were helpful in increasing their confidence in applying the strategies they were already familiar with although the effectiveness of the use of leaflets alone without the use of verbal instructions is not clear and it is possible that the positive outcomes were a result of this combined approach (Mitchell et al., 2013). Interestingly, in contrast to these positive findings, although 96% of health visitors reports giving out leaflets, only 29% are confident that doing so increases knowledge and only 3% were confident that doing so changed behaviour (Murphy & Smith, 1993). For example, Fowler, Fuller, Mant, and Jones (1989) evaluated the effectiveness of a leaflet distributed to a random sample of 5000 UK general practitioners containing guidelines on smoking cessation in changing behaviour. About half remembered receiving the leaflet, 27.7% reported reading it and only 8.8% could write down any of the three essential activities in smoking cessation which the leaflet intended to promote which were printed in bold letters on the inside.

1.13.2 Targeted Interventions

Health professionals often recommend research- led educational group interventions targeted at increasing parents' knowledge and understanding of eating behaviours in children in an attempt to reduce eating problems and increase healthy feeding practices (Mitchell et al., 2013). For example, Haywood and McCann (2009) initiated the "Fun with Food" educational programme to address the high numbers of child eating problems including food fussiness experienced within ethnic minority groups residing in London, UK. "Fun with Food" is a preventive intervention aimed at challenging eating problems in early childhood to prevent more serious difficulties from emerging in late childhood, adolescence and adulthood. The programme involves informal observations of child and parent interactions during mealtimes where parents are specifically instructed not to pressurise their child to eat as well as setting challenges such as graded reduction of force feeding or reduction of portion sizes to reduce the child's anxiety. The "Fun with Food" programme has been shown to result in an improvement in the range of food eaten by children with eating problems including food fussiness in comparison to pre-intervention reports (Haywood & McCann, 2009). Another positive outcome of the "Fun with Food" intervention was the feedback provided by parents such as being able to gain information that was specifically related to their family and the group setting in which parents were able to listen to other parents talk about their own children's eating problems resulting in reduced parental anxiety (Mitchell et al., 2013).

A similar research led educational strategy recommended by health professionals is the "Fun not Fuss with Food" programme (Fraser, Wallis, & John, 2004). This intervention was founded on the principles of social learning theory to increase positive parent-child interaction and reduce coercive parental feeding practices that may exacerbate child food fussiness. Parents of children with eating problems including food fussiness aged 2 - 10 years were recruited to participate in the 2.5 hour "Fun not Fuss with Food" programme. These parents were referred to the programme by their doctor, health worker or self- referred due to their concerns about their children's problematic eating behaviours. Parents were educated on childhood nutrition and on strategies such as verbal instruction, modelling and positive reinforcement to increase diet variety in their fussy children. Parents completed the Children's Eating Behaviour Inventory (CEBI-R; Archer, Rosenbaum, & Streiner, 1991) before and after the intervention with post intervention scores showing a significant reduction in food fussiness. Although the "Fun not Fuss with Food" programme resulted in significant reduction of food fussiness, the extent to which these benefits persisted with time is not known (Mitchell et al., 2013).

Lowe, Horne, Tapper, Bowdery, and Egerton (2004) developed the "Food Dudes" programme, a 16-day school-based intervention aimed at increasing food familiarity. In this programme, children watched a series of short videos about superhero peers called the Food Dudes who are seen enjoying eating fruit and vegetables and encourage viewers to do the same. The Food Dudes wage war against the unhealthy food-eating "Junk-Punks" and implore children to "keep the life force strong". During the "Food Dudes" programme, children are rewarded with non-food items for eating fruits and vegetables and teachers used classroom wall charts and rewards to maintain long-term consumption (Lowe et al., 2004).

In the U.S, Hendy, Williams, and Camise (2005) developed the "Kids Choice" school lunch programme as an intervention to increase fussy eater's acceptance of fruit and vegetables. The programme made use of token reinforcement to increase consumption of fruit and vegetables. This is similar to the strategy used by many parents of fussy eaters in which children are rewarded for eating a disliked food. Using techniques such as token reinforcement to increase food consumption has been found to be associated with over justification effects which can be described as a drop in food preference after a period of initial liking (Lepper, Greene, & Nisbett, 1973). The "Kids Choice" intervention however was designed to avoid these over justification effects. Rolls et al. (1981) proposed that over justification effects occur as a result of satiation. According to this explanation, studies that make use of reinforcement to increase food preference expose children to a particular disliked food for too long and provide large quantities of the disliked food, consequently, children may reach a satiation point resulting in reduced preference for that specific food. Hendy, Williams, and Camise (2005) therefore required children to consume at least 1/8th of a cup of fruit or vegetable, an amount specifically chosen to reduce satiation effects while also being a quarter of the recommended serving size of fruits and vegetables for children. Children were rewarded with tokens which they could trade in for prizes. Pre and post programme comparison scores showed an increased preference for fruit and vegetables two weeks after the programme without over justification effects. A notable finding however was that children's liking for fruit and vegetables returned to baseline after seven months which the researchers interpreted as a requirement for an on-going lunch programme to sustain preference.

1.13.3 Parental education

1.13.3.1 Exposure and reinforcement

Several studies have combined repeated exposure with positive reinforcement to encourage food acceptance in fussy children. In a school setting, Cooke, Chambers, Añez, and Wardle (2011) compared 4-6-year-old children's acceptance of a disliked vegetable in exposure plus reward versus exposure only conditions. Cooke et al. (2011) observed increased vegetable acceptance in both conditions, however, after 3 months has elapsed, the effect was only maintained in the exposure plus reward condition. The "Tiny Taste" study (Remington, Añez, Croker, Wardle, & Cooke, 2012), a research-led parent administered intervention which combined repeated taste exposure with small rewards demonstrated the effectiveness of a parent-delivered programme in that it increased fussy 3-4 year old children's acceptances and liking of an initially disliked vegetable. This study was conducted in the confines of the home environment and compared 12 daily parent-administered taste exposure sessions with tangible rewards (stickers), 12 daily parent-administered taste exposure sessions with social rewards (praise) and a no intervention condition. The results showed that repeated taste exposure combined with both tangible and social rewards increased vegetable acceptance, which was still evident at a three-month follow-up, although the effect was greater with tangible rewards.

Research highlighted above demonstrates the positive effects of repeated taste exposure and positive reinforcement in increasing food acceptance in young children. In addition, the use of exposure as an intervention has been found to be more effective in comparison to the use of leaflets (Wardle et al., 2003).

However, implementing exposure in the home environment can be very difficult. For example, it has been reported that parents are unwilling to push their children to taste a food repeatedly if they think it will result in troublesome behaviour (Carruth & Skinner, 2000). In addition, some parents are also reluctant to try new foods and have restricted diets themselves, consequently such parents will provide a limited diet for their children (Carruth & Skinner, 2000; Wardle et al., 2005). Repeated taste exposure has also been reported to lead to decreased desire for the exposed food in some situations (Birch & Deysher, 1985; Pliner, 1982)

Considering these negative effects, various researchers have explored other means of enhancing food familiarity and acceptance that do not involve tasting food repeatedly. Recent research has focused on the role of visual exposure in enhancing children's interest and willingness to taste new foods. In the UK, Houston-Price et al. (2009) provided parents of toddlers aged between 17-27 months with books containing pictures and information about fruit and vegetables. Parents were asked to read with their children on a daily basis for either a period of one, two or three weeks. The effect of the intervention on children's interest in the target foods was subsequently measured in terms of children's visual preference i.e. the time they spent looking at pictures of exposed fruits or vegetables rather than pictures of non-exposed foods. It was reported that across a series of three studies, the picture book intervention was successful in making children spend a significantly longer amount of time attending to the fruits and vegetables they had seen in their books. The authors reported that stronger effects were experienced when parents read to their children daily for a fortnight. In a second study, Houston-Price, Butler, and Shiba (2009), explored whether picture books influenced children's willingness to taste new foods in a similar way that it enhanced their interest. Parents of toddlers whose ages ranged between 21 and 24 months were asked to read a picture book about two familiar foods (sweetcorn and strawberries) and two unfamiliar foods (radishes and lychees) daily for a fortnight. Children were invited to take part in a “taste test”, where they were offered a plate of four vegetables followed by a plate of four fruits. Each child had previously seen two of the four items offered on the plate in their picture books. Children were subsequently encouraged children to taste the presented foods and the order in which foods were touched or tasted was recorded. It was reported that children tasted significantly more familiar than unfamiliar food. However, the order in which children approached the unfamiliar food on the plate was affected by the books they had been reading with children touching the vegetable they had seen in their books before the non-exposed vegetable. Children were also observed to taste exposed fruits before non-exposed fruits but there was no effect of exposure on the order in which vegetables were tasted.

Books have also been used as a means of modelling healthy eating to children. For example, in the Netherlands, De Droog, Buijzen, and Valkenburg (2014) investigated whether a book promoting carrots can increase young children’s consumption of carrots. This study made use of a book in which the main character is able to rescue his friend only after eating carrots to make him fit and strong. 104 children aged from 4-6 years participated in shared reading sessions using the book for five consecutive days in school. It was observed that in comparison to a baseline group of 56 children who were not exposed to the book, the children who were exposed consumed twice as many carrots in proportion to other foods consumed. It can be argued that in this book children received visual exposure as well as modelling, so it is not clear whether one of both of these features was effective. Nonetheless, taken together these studies provide evidence that interventions that do not involve repeated taste exposure can influence the foods that children are willing to try.

1.13.3.2 Child education

Some studies have explored the effectiveness of children’s “hands-on” interaction with vegetables in increasing familiarity and subsequent consumption. In the US, Morris and Zidenberg-Cherr (2002) developed a school-based “garden- enhanced nutrition curriculum”. 213 children aged 9 -10 years of diverse ethnic groups were asked to taste and rate their preferences for six vegetables on a 5-point scale where 5 indicated “really liked it a lot” and 1 indicated “really did not like it”. Vegetables that children tasted included carrots, snow peas, broccoli, spinach, zucchini and jicama. Children were then assigned to one of three study conditions. The first group of children (n = 81) received in-class nutrition lessons and took part in the curriculum that required them to participate hands-on gardening activities which involved planting and harvesting of their own vegetable gardens. Vegetables included in the curriculum included carrots, snow peas and broccoli. The second group of children (n= 71) received in-class nutrition lessons only while the third group of children (n= 61) received neither the nutrition nor garden education. It was reported that in comparison to children who did not participate in the garden curriculum, the young gardeners had greater post-test preference scores. Children exposed to hands on gardening also showed an increased knowledge of the vegetables they had helped to grow, consumed more of these vegetables at home and were more likely to ask their parents to buy the target vegetables for home mealtime consumption. Most importantly, the authors reported that that the gardening activities increased children’s preferences for vegetables that they had not grown in the garden and increased liking was still evident six months after the intervention. A similar finding was observed by Heim, Stang, andIreland (2009) also in the US who reported a significant increase in fussy children’s willingness to try new fruit and vegetable after participating in a 12-week garden -based activity programme. Due to these successes, it has been recommended that children should have hands-on experience in the growing and preparation of fruits and vegetables at home (European Food Information Council; EUFIC, 2010; Department for the Environment, Food and Regional Affairs in the UK; DEFRA, 2010).

The use of cooking classes as a hands-on intervention to increase food familiarity in fussy eaters has been explored by some researchers. In the US, Liquori, Koch, Contento, and Castle (1998) evaluated the effectiveness of a nutrition education intervention called the “Cookshop Programme” on children aged 5-11 years of age. It was designed to increase preference for the consumption of fruits and vegetables through cooking these foods in the classroom in conjunction with multiple exposures in the school cafeteria and parental involvement. The intervention compared cooking as an educational strategy to food and environmental lessons in which children were taught the benefits of eating fruit and vegetables without any hands-on participation. It was observed that taking part in cooking increased children's fruit and vegetable preference which led Liquori et al. (1998) to suggest that the actual act of cooking and eating with peers may provide a promising approach to nutrition education and increase food familiarity and preference. Similarly, Brown and Hermann (2005) developed an educational programme to provide knowledge on basic fruit and vegetable preparation with an aim to increase consumption. The programme included classes aimed to teach different methods in which a variety of fruits and vegetables can be cooked such as stir-frying, microwaving, baking, pressure cooking, grilling or incorporating fruits into smoothies, soups, salads or desserts. Participants, who were youths and adults with ages ranging from 12-57 years, were encouraged to have hands -on experience with the preparation of foods and taste the products prepared. The impact of the programme on fruit and vegetable consumption was evaluated using a pre and post education questionnaire. Brown and Hermann (2005) reported significant increases in the amount of fruit and vegetables consumed per day for both youth and adult participants.

The studies aimed at increasing children's familiarity reviewed above have demonstrated that children's hands-on interaction with fruits and vegetables increased acceptance and liking. However, although these interventions have been found to improve eating problems in children, the continuous nature of these improvements remains unclear. It is also unknown how effective these interventions are for children who did not consume vegetables prior to participation. It is reasonable to emphasize that there will be differences in consumption between children who had a prior liking for the presented vegetables and children who never liked and consumed the presented vegetables prior to the intervention.

1.14 Rationale for current study and research questions

Given the negative health implications associated with child food fussiness (Ekstein et al., 2010; Tharner et al., 2015) and its impact on familial relationships (Sanders et al., 1993; Timimi et al., 1997) identifying potential risk factors for its development is an important first step in prevention and the implementation of interventions. Although progress has been made in the development and implementation of interventions to support parents of fussy eaters, interventions are not widely available and can be costly to providers. It is also not currently clear which children are most likely to become fussy eaters and therefore which families should be prioritised for interventions. Interventions that prevent the development of food fussiness would be useful and an important first step in developing such interventions is to know which children are mostly likely to be fussy eaters.

Given that the feeding process is bi-directional with parents and children both playing a contributory role (Cabanac, 1985), it is necessary to investigate both parent and child factors that may be potential risk factors for the later development of food fussiness. Various characteristics of the parent and child have been reviewed in the preceding literature as being related to food fussiness. Research has highlighted the influences of child temperament (e.g. Hafstad et al., 2013; Haycraft et al., 2011; Jacobi et al., 2003.; Pliner & Loewen, 1997), maternal symptoms of depression, anxiety and stress (e.g., Blissett et al., 2007; Coulthard & Harris, 2003; de Barse et al., 2016; McDermott et al., 2008) and maternal core beliefs (e.g., Blissett et al., 2005; Farrow & Blissett, 2006) in the development of child food fussiness. There is also evidence of an association between child sensory hyperreactivity and food fussiness in cross-sectional (e.g., Farrow & Coulthard, 2012; Nederkoorn, Jansen, & Havermans, 2015; Zucker et al., 2015) and longitudinal studies (e.g., Steinsbekk, Bonneville-Roussy, Fildes, Llewellyn, & Wichstrøm, 2017). Further, parents use of controlling feeding practices such as pressure and restriction have been found to be associated with increased food fussiness in children (e.g., Galloway et al., 2005; Jansen et al., 2012; Webber, Hill, Cooke, Carnell, & Wardle, 2010). However, research examining more than one of these factors in one study remains rare and, as such, it is difficult to determine how these parent and child characteristics relate to food fussiness. There are also methodological limitations in previous studies and inconsistencies in the existing findings making it difficult to clearly identify important child and parent characteristics that predict food fussiness. For example, while Farrow and Blisset, (2006) examined the association between child temperament, maternal psychopathology, maternal core beliefs, maternal self-esteem and food fussiness in 6 month old infants, there is a lack of studies examining these child and parent variables together in older children, especially in their second year of life, when food fussiness becomes more evident. As previously highlighted in pp. 14-15, parents have an increased perception of food fussiness in children aged 2-4 years, therefore research examining relationships between child and parent factors and food fussiness in this age group is important as factors with the strongest relationships could be targeted for interventions aimed at addressing food fussiness. Further, most research on child food fussiness has predominantly relied on the use of parent self-report measures to obtain a measure of food fussiness (e.g., Blissett et al., 2005; Hafstad et al., 2013; Haycraft et al., 2011) which can be subjective and produce biased responses. Independent observations of children's eating could help determine the reliability of parent -report by examining whether parental responses on a child food fussiness psychometric measure aligns with observations of child mealtime behaviour and dietary intake.

The principal objective of this thesis was therefore to examine food fussiness in children aged 2-4 years in relation to child and maternal factors and comprised four studies:

The first study in this thesis aimed to determine the relationship between child and maternal factors and food fussiness. Study 1 aimed to address the following research question: How do child temperament, maternal psychopathology, maternal core beliefs and self- esteem relate to child food fussiness? This study made use of parent-report measures to measure food fussiness. As previously discussed above, the use of parent-report is associated with subjective and biased responses questioning its reliability. However, this method was used to measure child food fussiness in Study 1 as it was a convenient means to obtain responses from a large sample and food fussiness was subsequently validated in Study 2.

Given the previously discussed limitation associated with the use of parent-report to assess child food fussiness, Study 2 validated maternal reported child food fussiness by examining the relationship between maternal-reported scores on the food fussiness subscale of the CEBQ (Wardle et al., 2001) and independent observations of children's food rejection and food acceptance behaviours during a video recorded mealtime in the home environment. Study 2 addressed the following research question: Does maternal reports of children's food fussiness correspond to independent observations of children food rejection and acceptance behaviours?

Study 3 aimed to investigate whether maternal feeding practices influences the association between higher emotional child temperament and food fussiness. Study 3 addressed the following research question: Does observed maternal use of controlling feeding practices namely use of pressure, physical prompts, food rewards and non-food rewards moderate the relationship between emotional child temperament and food fussiness?

Finally, in Study 4, the relationship between children's sensory processing and emotional temperament was examined in relation to food fussiness. The following research question was addressed in Study 4: Does sensory hyperreactivity in children explained variance over and above emotional child temperament in explaining food fussiness? An additional aim of study 4 was to explore possible interactions between sensory hyperreactivity and emotional child temperament in predicting food fussiness.

Chapter 2: The relationship between child temperament, maternal symptoms of psychopathology, maternal core beliefs and food fussiness.

2.1 Abstract

Food fussiness has been shown to have serious consequences for children's health and is associated with higher levels of parental stress. Identifying potential risk factors for the development of food fussiness is therefore an important initial step in its prevention. Previous research has identified a range of parent and child factors associated with food fussiness, however findings are inconsistent, and it remains unclear how to identify factors that are strongly associated with food fussiness. The aim of this study was to examine the relationship between child temperament, maternal core beliefs, maternal self-esteem and maternal psychopathology and food fussiness in young children. One hundred and seventy-four mothers of children aged 2- 4 years completed questionnaires assessing child temperament and food fussiness, and maternal mental health, core beliefs and self-esteem. Hierarchical regression analysis revealed that child temperament explained the majority of variance in maternal reports of food fussiness. Specifically, higher emotionality, lower activity and lower shyness are associated with greater food fussiness. Mothers' education and subjugation beliefs also accounted for significant variance in food fussiness, with longer time spent in education and lower subjugation beliefs associated with greater food fussiness. There was no significant influence of maternal self-esteem, mental health or other core beliefs. The key finding of this study was that when all significant child temperament predictors were included in a follow up regression analyses, children's emotionality emerged as the strongest predictor of food fussiness.

2.2 Introduction

As previously discussed in Chapter 1, pp. 39-40, factors examined in this thesis were selected broadly on the basis of a biopsychosocial model of feeding problems and specifically from previous literature. There is a plethora of research linking child temperament, maternal symptoms of psychopathology and maternal core beliefs to child food fussiness. As discussed in Chapter one (pp. 44-46), food fussiness has been found to be associated with difficult child temperament (Farrow & Blissett, 2006; Hagekull, Bohlin, Rydell, & Mothander, 1996), shy temperament (Pliner & Loewen, 1997), negative affect (Jacobi et al., 2003) and with emotional temperament (Hafstad et al., 2013; Haycraft et al., 2011; Pliner & Loewen, 1997; Powell, Farrow, & Meyer, 2011). The relationship between food fussiness and maternal symptoms of psychopathology has also been investigated in several studies. As previously discussed in chapter one (pp. 47-48), cross sectional data report an association between food fussiness and maternal depression and anxiety (e.g., Ammaniti, Lucarelli, Cimino, D'Olimpio, & Chatoor, 2010; Blissett et al., 2007). However, the direction of this relationship is somewhat unclear, as one longitudinal study found maternal anxiety to be a consequence of child food fussiness (Coulthard & Harris, 2003) and another found that maternal anxiety during the child's early years significantly predicts later food fussiness (McDermott et al., 2010). Alongside maternal mental health, unhealthy maternal core beliefs have also been implicated as risk factors for the development of child food fussiness. As discussed in chapter one (p. 52), positive associations have been found between food fussiness and the core beliefs of abandonment, failure to achieve, subjugation beliefs, emotional deprivation, enmeshment, dependence/incompetence and defectiveness/shame in mothers of children aged 7- 64 months (e.g., Blissett et al., 2005). As previously discussed in chapter one (p. 53), low self-esteem has also been found to be associated with unhealthy maternal core beliefs and maternal depression (e.g., Schmidt et al., 1995; Beck, 2001) which have both been found to be implicated in the development of food fussiness (Blissett et al., 2005; de Barse et al., 2016). While low maternal self-esteem has been found to be a significant predictor of food fussiness in infancy (Farrow & Blissett, 2006), associations between maternal self-esteem and child food fussiness in early childhood remains to be investigated.

Research examining the relationship between parent and child factors and food fussiness together in a single study would be useful in determining how these factors relate to food fussiness and in identifying factors that are strongly associated with food fussiness. To date, research examining more than one of these factors remains rare and, as such, it is difficult to identify important correlates of food fussiness on the basis of child and parent characteristics that could be targeted for interventions aimed at addressing food fussiness.

As previously discussed in Chapter one (pp. 55-56) there are also methodological limitations in previous studies and inconsistencies in the existing findings making it difficult to clearly identify important child and parent characteristics that predict food fussiness. For example, while Farrow and Blissett (2006) examined the association between child temperament, maternal psychopathology, maternal core beliefs, maternal self-esteem and food fussiness in 6 month old infants, there is a lack of studies examining these child and parent variables together in older children, especially in their second year of life, when food fussiness becomes more evident.

The aim of this study was to examine the relationship between child temperament, maternal symptoms of psychopathology, maternal core beliefs and self-esteem and maternal reported child food fussiness.

Addressing the methodological limitations of previous studies investigating child and parent factors, this study will control the order in which mothers complete the questionnaires such that mothers are given the child food fussiness questionnaire last to avoid confounding influences on responses on the child temperament, maternal psychopathologic, maternal core beliefs and self-esteem questionnaires.

On the basis of previous research, it was hypothesized that:

1. Higher scores on emotional and shy temperament scales will predict maternal reported child food fussiness.

2. Higher depression, anxiety and stress scores will predict maternal reported child food fussiness.
3. Higher unhealthy maternal core beliefs scores and lower maternal self-esteem scores will predict maternal reported child food fussiness

2.3 Method

This study was approved by the University of Reading School Research Ethics Committee (SREC 2014/068/KH). There were two key ethical considerations relating to this study. The first that participants were invited to complete questions related to depression, anxiety, and self-esteem which could potentially cause distress. To address this, participants were provided with an information leaflet specifying contact details of potential sources of support (such as their GP). Similarly, because participants were invited to complete questionnaires about their child's eating, links to websites about healthy eating were provided, and it was recommended that any participant with concerns about their child's eating should contact their GP.

2.3.1 Design

A quantitative approach using standardized self-report questionnaires was used to address the research question. Although self-report questionnaires are limited by biased and subjective responses as previously highlighted in Chapter one (pp. 8-9), this method was used in this study as it was a convenient means to obtain responses from a large sample. In this within-subjects cross sectional study, mothers of children aged 2- 4 years were asked to complete a series of standardised questionnaires relating to their child's child food fussiness and temperament as well as levels of maternal distress, maternal patterns of thinking and maternal self-esteem. Mothers were also asked to complete a demographic questionnaire.

2.3.2 Participants

174 mothers of children aged 2-4 years (Mean =3.04 years, SD =0.80) completed the questionnaires. There were 83 mothers of boys and 91 mothers of girls.

The majority of mothers were aged between 31-40 years (52.3%). 71.2% of mothers were married or living with a partner and over half (57.8%) had attained undergraduate or postgraduate qualifications. Mothers were of diverse ethnicities assessed using the Office of Population Censuses and Surveys (OPCS; 2003) ethnic classification with the majority being white British (52.9%). (See Table 2.1 below for participant characteristics).

Table 2-1 Study 1 Participant Characteristics (N = 174).

Sociodemographic variables	Number of participants	n (%)
Sex of Child		
Male	83	47.7%
Female	91	52.3%
Maternal Age		
Under 25s	25	14.4%
25-29 years	32	18.4%
30-34 years	50	28.7%
35-39 years	41	23.6%
40-44 years	24	13.8%
45-49 years	2	1.1%
Maternal Education		
Up to primary school	4	2.3%
Up to secondary school	71	40.8%
Up to Undergraduate degree	66	37.9%
Up to Postgraduate degree	33	19%
Marital Status		
Single	33	19%
Living Together	35	20.1%
Married	89	51.1%
Separated	6	3.4%
Divorced	10	6%
Widowed	1	0.6%
Maternal Ethnicity		
White British	92	52.9%
White Irish	8	4.6%
White other	19	10.9%
Black Caribbean	15	8.6%
Black African	12	6.9%

Black other	2	1.1%
Mixed (Black Caribbean/White)	4	2.3%
Mixed (Black African/ White)	3	1.7%
Mixed (Asian/ White)	3	1.7%
Mixed other	4	2.3%
Asian Indian	3	1.7%
Asian Pakistan	2	1.1%
Asian Chinese	3	1.7%
Asian other	1	0.6%
Other ethnic group	3	1.7%

2.3.3 Measures

2.3.3.1 Emotionality Activity Sociability Scale (EAS; Buss & Plomin, 1984)-Appendix A

The EAS was used to measure child temperament. The EAS is made up of 20 statements assessing four dimensions of children's temperament: (1) Emotionality reflects the tendency to become easily and intensely aroused e.g. my child cries easily; (2) Activity refers to high levels of activity and speed at performing actions e.g. my child is off and running as soon as he wakes up in the morning; (3) Shyness refers to a tendency to being inhibited in new social situations e.g. my child tends to be shy; (4) Sociability reflects the tendency to prefer the company and presence of others rather than being alone e.g. my child likes to be with people. Respondents are asked to rate on a 5-point Likert scale (1= not characteristic or typical of your child to 5 = very characteristic or typical of your child) how well these statements described their child's behaviour. Scores for each subscale are calculated by determining the sub-scale mean, with higher scores indicating that the trait is more typical of the child. The EAS has been found to have good internal reliability with alpha values exceeding 0.70 (Ganiban, Saudino, Ulbricht, Neiderhiser, & Reiss, 2008; Saudino, McGuire, Reiss, Hetherington, & Plomin, 1995) and high test-retest correlations ranging from 0.58 for sociability to 0.70 for activity over a period of 9 months (Goodyer, Ashby, Altham, Vize, & Cooper, 1993). In the present study, Cronbach's alphas for emotionality, activity, sociability and shyness were 0.75, 0.69, 0.71 and 0.77 respectively. The EAS temperament survey was chosen for use in the present study because of its brevity and its use in related studies on eating in children of a similar age (e.g., Hafstad et al., 2013; Haycraft et al., 2011).

2.3.3.2 The Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995) - Appendix B

The DASS-21 was used to measure maternal psychopathology. The DASS is a self-report quantitative measure of psychological distress consisting of three scales measuring depression, anxiety and stress. The DASS-21 is a 21-item questionnaire with seven items for each scale. The items in the depression scale measure dysphoric mood, low incentive and anhedonia with statements such as “I felt I wasn't worth much as a person”. Items in the anxiety scale are related to physiological hyper arousal and measure subjective and autonomic responses to fear and anxiety related situations, with statements such as “I felt scared without any good reason”. Items in the stress scale measure nervous tension and reactivity to frustration and vexation with statements such as “I found myself getting agitated”. Respondents are asked to indicate the extent to which each statement applied to them over the past week on a 4-point Likert scale (0 = “did not apply to me at all”, 3 =” applied to me very much, or most of the time”). Respondents receive a separate score for each subscale, total scores for each subscale are calculated by summing the scores, with higher scores indicating greater symptomology.

The internal consistency, convergent and divergent validity of the DASS-21 has been found to be similar across diverse racial groups (Norton, 2007). Further, the DASS-21 has been found to have good internal consistency with Cronbach’s Alpha values ranging from 0.73-0.90 (Henry & Crawford, 2005; Lovibond, 2004). In the present study, Cronbach’s alphas for depression, anxiety and stress were 0.88, 0.81 and 0.92 respectively.

The DASS -21 was chosen for use in this study for the following reasons: (1) It is a measure of psychopathology that incorporates a measure of stress. Food fussiness has been found to be associated with increased parental stress (2) It is a succinct measure of psychopathology which has been tested and found to be valid in non-clinical populations.

2.3.3.3 The Rosenberg Self Esteem Scale (RSES; Rosenberg, 1965) - Appendix C

The RSES was used to measure maternal self-esteem. The RSES is a 10-item one-dimensional measure of global self-esteem which is used extensively in the field of psychology. The items that make up the RSES consist of 5 positively worded statements and 5 negatively worded statements that reflect positive and negative evaluations of the self-e.g. ”I feel that I am a person of worth, at least on an equal plane with others” (positive) and “All in all, I am inclined to feel that I am a failure” (negative) (Rosenberg, 1965). The 5 positively worded statements are scored on a 4-point scale where 0= Strongly Disagree, 1 = Disagree, 2 = Agree and 3= Strongly Agree. The 5 negatively worded statements are reversed scored so that 0= Strongly Agree, 1 = Agree, 2= Disagree and 3= Strongly Disagree. A global self-esteem score is calculated by summing all scores, with scores ranging along a continuum from low self-esteem to high self- esteem (Rosenberg, 1965). The uni-dimensional factor structure of the RSES has been confirmed in studies that have used the RSES in adolescent and adult non-clinical populations (Fleming & Courtney, 1984; Schmitt & Allik, 2005; Whiteside-Mansell & Corwyn, 2003). The RSES has been found to have high test-retest reliability and high internal consistency with Cronbach’s alpha for various samples ranging from 0.77 to 0.88 (Blascovich & Tomaka, 1991; Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995). In the present study, Cronbach’s alpha for the RSES was 0.79.

It was decided to measure maternal generic self-esteem rather than parenting esteem or efficacy as maternal responses on parenting efficacy scales were likely to confound responses on any subsequent child feeding questionnaire and vice-versa. Parenting efficacy scales measure parents’ beliefs in their own competence as parents. Parent efficacy measures such as the Parenting Efficacy Scale (Teti & Gelfand, 1991) ask parents to rate how good they think they are at various child-care activities including feeding. Consequently, if mothers rated their children as being fussy on the FF scale of the CEBQ, this was likely to influence how competent she feels at feeding on a subsequent parent efficacy measure. Using a generic self-esteem measure like the RSES measured mothers' positive and negative evaluations about themselves that was unrelated to how they perceived their parenting skills.

The RSES was chosen for use in this study for its brevity, simplified language and the fact that it remains the most accessible measure of self -esteem that can be used in a community sample

2.3.3.4 The Young Schema Questionnaire (YSQ-S; Young, 1998) - Appendix D

The YSQ-S was used to measure maternal core beliefs. The YSQ is a 75-item measure of 15 core beliefs which are categorised into five higher order themes (Young, 1994).

1. Disconnection and rejection: - The core beliefs that represent this theme include: Emotional Deprivation, Abandonment, Mistrust/Abuse, Social Isolation and Defectiveness/Shame. Emotional deprivation is the perception that one will not receive sufficient emotional support from significant others, e.g. "Most of the time, I haven't had someone to nurture me, share him/ herself with me, or care deeply about everything that happens to me". Abandonment is the belief that those close cannot be relied on, e.g." I worry that people I feel close to will leave me or abandon me". Mistrust/Abuse is the feeling that one is open to exploitation and at risk of others taking advantage, e.g. "I'm usually on the lookout for people's ulterior motives". Social Isolation is the perception of being detached from a group, e.g. "I feel alienated from other people". Defectiveness/ Shame is the notion that one is unlovable and inherently flawed e.g. "I'm unworthy of the love, attention and respect of others".
2. Impaired Autonomy and Performance: - Failure to achieve, Dependence/Incompetence, Vulnerability to Harm and Enmeshment are the core beliefs that comprise this theme. Failure to achieve is a feeling of inadequacy, an expectation of impending failure in all areas of one's life, e.g. "Almost nothing I do at work (or school) is as good as other people can do". Dependence/Incompe-

tence is a belief that one is unable to deal with one's responsibilities adequately and on one's own, e.g. My judgement cannot be relied upon in everyday situations". Vulnerability to Harm is the overemphasis on an impending danger, e.g. "I can't seem to escape the feeling the something bad is about to happen". Enmeshment is the intensive emotional attachment to the lives of significant others, e.g. "I have not been able to separate myself from my parent(s), the way other people my age seem to".

3. Other Directedness: - The core beliefs of Subjugation and Self-Sacrifice comprise this theme. Subjugation involves relinquishing control to others due to feelings of being pressurized, e.g. "I've always let others make choices for me, so I really don't know what I want for myself". Self-sacrifice is the immoderate attention to other's needs at one's own expense, e.g. "I'm so busy doing things for the people that I care about, that I have little time for myself".
4. Over-Vigilance and Inhibition: - The core beliefs of Emotional Inhibition and Unrelenting Standards fall under this theme. Emotional Inhibition is extreme reservation in expressing feelings or in communicating, e.g. "I find it embarrassing to express my feelings to others". Unrelenting Standards is the placing of excessive emphasis on perfectionism and sets rigid rules, e.g. "I feel there is constant pressure for me to achieve and get things done".
5. Impaired Limits: - Entitlement and Insufficient Self-Control are the core beliefs that come under this theme. Entitlement is the perception that one is superior, entitled to special advantages with excessive requirement for power and control, e.g. "I feel that what I have to offer is of greater value than the contribution of others". Insufficient Self-Control is the difficulty in exercising self-control or the inability to withstand frustrating situations, e.g. "I can't seem to discipline myself to complete routine or boring tasks".

Each schema consists of five items and respondents are asked to rate on a 6-point Likert scale ranging from 1= Completely untrue of me to 6= Describes me perfectly, how well each statement applies to them.

Several studies have demonstrated adequate psychometric properties for the YSQ-S (e.g., Waller, Meyer, & Ohanian, 2001; Welburn, Coristine, Dagg, Pontefract, & Jordan, 2002). The YSQ has been shown to have good construct validity in clinical (Lee et al., 1999; Waller, Shah, et al., 2001) and in non-clinical populations (Dobrenski, 2001; Rittenmyer, 1997) as well as good discriminative power (Shah & Waller, 2000; Waller, Shah, et al., 2001).

Previous studies have found an association between 7 of the 15 YSQ-S maternal core beliefs and child food fussiness (e.g., Blissett et al., 2005; Farrow & Blissett, 2006). The core beliefs found to be associated with child food fussiness include emotional deprivation, abandonment, enmeshment, defectiveness, failure to achieve, dependence/Incompetence and subjugation of beliefs. The present study therefore only includes these seven maternal core beliefs. The YSQ-S was chosen for use in this study because it has been shown to be a valid and reliable measure of unhealthy core beliefs which has been widely used in non-clinical populations (Schmidt et al., 1995; Waller, Shah, et al., 2001). In the present study Cronbach alphas for emotional deprivation, abandonment, defectiveness, failure to achieve, dependence/incompetence, enmeshment and subjugation of beliefs were 0.87, 0.83, 0.80, 0.84, 0.79, 0.85 and 0.84 respectively.

2.3.3.5 CEBQ (Wardle et al., 2001)- Appendix E

The CEBQ is a 35-item multi-dimensional parent-report psychometric questionnaire that was developed to measure eight dimensions of children's eating behaviour. The constructs of the CEBQ were obtained from the evaluation of the existing adult and children's eating style literature and from interviews with parents about their children's eating behaviour (Wardle et al., 2001). This study made use of the Child Food Fussiness subscale of the CEBQ to assess child food fussiness. The Child Food Fussiness subscale is made up of six statements e.g. my child is interested in tasting food he/she hasn't tasted before. Respondents rate on a 5-point Likert scale (1= never, 5= always) how applicable these statements are to their child's eating behaviour. Mean scores are calculated for each respondent with possible scores ranging from one to five and higher scores reflecting greater child food fussiness. Wardle et al. (2001) reported the Child Food Fussiness subscale to have a high internal consistency (Cronbach's alpha =0.91) and a high test-retest reliability (r= 0.87). In the present study, Cronbach's alpha for Child Food Fussiness was 0.96. The six items on the food fussiness subscale have also been found to be negatively correlated to positive responsiveness to food (Wardle et al., 2001). This scale was chosen for being a succinct measure of child food fussiness that has been tested in children in the target age group and found to be valid and reliable (e.g., Tharner et al., 2014).

2.3.3.6 Socio-Demographic Questionnaire- Appendix F

This questionnaire asked for background information about the child's age and gender (male or female) as well as the information about the mother's age, education, marital status and ethnicity. Maternal ethnicity was evaluated using the Office of Population Censuses and Surveys (OPCS; 2003) 17 group ethnic classification which combines ethnic and national group dimensions (e.g. White Irish, Black African, Asian Pakistan). Maternal age group was assessed using the Office for National Statistics (ONS; 2001, 2011) classification which groups ages of the UK population in five -year age bands (e.g. 25- 29, 30- 34). Marital status was also assessed using the Office for National Statistics (ONS; 2001, 2011) classification which uses six categories of legal marital status (single, living together, married, separated, divorced and widowed). These categories indicate whether individuals are living with their partner or not irrespective of their legal marital status. Maternal educational categories were based on three stages of education in England; primary, secondary and tertiary education.

2.3.4 Procedure

Following ethical approval, several strategies were used to recruit mothers of children aged 2-4 years. Advertisements were placed in forums of social networking websites frequently used by mothers of young children and included Netmums, Huffpost, Facebook mums' group, Justparents.co.uk, ukparentslounge.com and Mumsnet. Letters were sent out to headteachers and managers of twenty-five nurseries and preschools in Reading and Surrey describing the study and asking if they would be willing to distribute leaflets describing the study to parents. In addition, mothers were approached by the researcher at mother and toddler groups, leisure centres and Sure-Start centres in Reading and Surrey. In this situation, mothers were given a brief verbal description of the study and asked if they would be willing to complete the questionnaires. Interested mothers were given the option to complete the questionnaires electronically online or manually in paper form (See Appendix G for internet advert, Appendix for H for leaflets, Appendix I for contact letter for headteachers/managers of nurseries, Appendix J for participant information sheet and Appendix K for consent form). The order in which mothers completed the questionnaires was controlled to ensure that mothers completed the questionnaire about their child's eating behaviour last to avoid confounding influences on responses on the child temperament and maternal psychopathologic questionnaire. Questionnaires were therefore completed in the following order: EAS, DASS 21, RSES, YSQ-S, CEBQ-food -fussiness (FF) subscale and demographic information. Although more information on the child's overall eating behaviour would have been obtained using the 35 item CEBQ, it was decided to administer the six- item FF subscale of the CEBQ to mothers. This was mainly due to the fact that mothers were already completing several lengthy questionnaires and it was decided to only include the six-item FF scale for brevity. This was to avoid the possibility of mothers becoming bored, disengaged thus increasing the likelihood of non-completion. Informed consent was sought from mothers before the completion of the questionnaires. In total 67 questionnaires were completed online. It was not possible to estimate the response rate for mothers recruited from various avenues for questionnaires recruited online. 157 questionnaires were given to mothers to complete in paper form and, of these, 107 were completed and returned (response rate = 68.2%). 105 questionnaires were given to mothers from mother and toddler groups from which 90 were completed and returned (85.7% response rate). Mothers recruited from Sure Start centres completed and returned 9 out of 25 questionnaires (36% response rate) while 8 out of 27 completed questionnaires were returned from mothers recruited from leisure centres (29.6% response rate). Overall mothers recruited from mother and toddler groups had the highest response rate and completed more than half of the questionnaires for this study.

2.3.4.1 Data Analysis

Data were analysed using Statistical Package for Social Sciences (SPSS), version 22. Hierarchical regression analyses were used to determine the relative importance of child temperament, maternal psychopathology, maternal core beliefs and self-esteem in predicting child food fussiness. An initial check on the accuracy of data entry showed that the minimum and maximum values of all the study variables were within the expected range. The data set contained ten missing data points. A significant Little's MCAR's test, $p = 0.02$ indicated that the data points were not missing at random therefore missing data was excluded listwise leaving $N = 164$ cases for analysis. Although an advantage of listwise deletion is the ease at which it can be implemented and it is the default in many statistical packages, including SPSS, it has the disadvantage of causing loss of power diminishing the ability to detect an existing relationship or a decline in the probability of rejecting a null hypothesis (Myers, 2011). The present dataset had 10 missing data points representing about 5.7%. As indicated in the subsequent power analysis on p.106 below, deleting these cases did not lead to a substantial loss of participants as the final sample had sufficient power to detect medium effects justifying the use of listwise deletion in this analysis. Significant Shapiro-Wilk's tests established that most of the study variables were not normally distributed making the dataset unsuitable for parametric analyses. One case with an extremely low z score was identified as a univariate outlier. Another case was identified through Mahalanobis distance as a multivariate outlier with $p < 0.001$. Both outliers were removed from all further analyses leaving $N=162$ cases for analysis. The distributions of the variables were not improved by the removal of outliers or through log, reciprocal and square root transformations. A bootstrapping procedure to generate a 95% bias - corrected bootstrapped confidence intervals of the correlation coefficients (1000 samples, $N = 162$) were applied in all analysis. Bootstrapping is a procedure that allows inferences to be made from a dataset without making strong distributional assumptions

(Haukoos & Lewis, 2005). There are two distributions to take into account. First, the underlying distribution of the data itself that shows all the values that the variables can have and the likelihood that each will occur. Second, the distribution of the test statistic of interest calculated from the data. Normally distributed data permits the inference that the sampling distribution is normal and the probability of a particular test statistic occurring is known. With non-normally distributed datasets, however, the shape of the sampling distribution is unknown. Bootstrapping uses resampling with replacement to estimate the statistic's sampling distribution. The sampling distribution may then be used to estimate confident intervals for the test statistic. To estimate confident intervals using the bootstrapping approach, resampling with replacement is used to create m resampled data sets (called bootstrapped samples) that contain the same number of data points (n) as the original data set. Resampling with replacement is performed by randomly selecting a data point from the original data set and copying into the resampled data set being created. Although the data point has been used, it is not deleted from the original data set but has been replaced. Another data point is further randomly selected, and the process repeated until a resampled data set of size n is created. This results in the same data point being included in the resampled data point one, two or more times or not at all. The next step involves computing descriptive statistics of choice for each resampled data set. Finally, a confidence interval for the statistic is calculated from the collection of values obtained for the statistic (Haukoos & Lewis, 2005; Field, 2013). Suggests that as a general rule, 1000 or more resampled data sets should be used when calculating a bias corrected confidence interval and each bootstrap sample should have the same sample size as the original data set (Mooney & Duvall, 1993; Efron & Tibshirani, 1986).

To improve parsimony and to maintain power, it was decided to reduce the number of variables to be entered into the regression analyses by conducting a preliminary correlation analysis to examine the univariate relationships between the predictor variables (child temperament, maternal psychopathology, maternal core beliefs and maternal self-esteem), child and maternal socio-demographic variables and child food fussiness. Due to an increased risk of type 1 errors that could arise as a result of conducting multiple correlations, a more stringent significant level of $p < 0.01$ was used. The variables to be included in the final regression analyses were decided on the basis of a significant correlation with child food fussiness meeting the set criteria of $p \leq 0.01$. An assumption of correlation analysis is that the two measured variables are continuous or one of the variables is categorical with two categories only. The four maternal socio-demographic variables violate this assumption so were re-coded into dichotomous variables as follows:

Maternal ethnicity was re-coded into White British vs. Other (non-White-British). The majority of the respondents were White British, so this represented one category while other ethnic groups, all of which contained relatively few participants, were combined to form a second category labelled “Other Ethnicity”. “Other Ethnicity” was coded as 0 while “White British” was coded as 1.

Marital status was re-coded into Married or Living Together vs. Single (single, separated, divorced and widowed). Child food fussiness has been shown to be associated with significant parental stress (Goh & Jacob, 2012; Hagekull & Dahl, 1987; Sanders et al., 1993). There is also research citing that mothers in two-parent relationships receive more emotional and social support than single mothers which may help them cope better with stressful life situations (Weinraub & Wolf, 1983). This classification could therefore reveal if there are differences in the perception of child food fussiness by mothers in two-parent relationships versus single mothers. “Married or Living Together” was coded as 0 while “Single” was coded as 1.

Maternal age was re-coded into Younger (< 34 years) vs. Older (35-49 years) mothers. Parents of fussy eaters have been found to be younger than parents of non-fussy eaters (e.g., Machado, Dias, Lima, Campos, & Gonçalves, 2016). This classification could reveal if there are differences between younger and older mothers’ perception of child food fussiness. “< 34” years was coded as 1 while “35-49” years was coded as 0.

Maternal education was re-coded into No UG Degree vs. UG Degree or higher. Due to the small sample size in the category “Up to Primary school”, this category was combined with “Up to secondary school” to form one category labelled “No UG Degree”. Undergraduate and postgraduate degrees were combined to form the second category labelled “UG Degree or higher”. “No UG Degree” was coded as 0 while “UG Degree or higher” was coded as 1. This classification could reveal if maternal perception of child food fussiness varies depending on mothers’ level of education.

2.4 Results

2.4.1 Results of Correlation analysis

Descriptive statistics for child temperament, maternal psychopathology, maternal core beliefs, maternal self-esteem and child /maternal socio demographic variables are shown in Table 2.2 below along with the results of the Pearson’s correlation analysis between child food fussiness and the study’s independent variables. Mean scores on the EAS and CEBQ FF scale for children in this sample are comparable with those of previous studies that have used these measures with children of a similar age group in the UK and the Netherlands (e.g., Haycraft & Blissett, 2012; De Barse et al., 2016). Mean scores on the YSQ-S for mothers in this sample are in line with studies that have the used the YSQ with non-clinical UK samples (e.g. Waller et al., 2001; Blissett et al., 2005). Mothers mean scores on the depression and stress scales of the DASS-21 are comparable to those of another study that used the DASS-21 in a non-clinical US sample (e.g., Sinclair et al., 2012). However, the current sample of mothers had a higher mean score on the anxiety subscale of the DASS-21 than mothers in the Sinclair et al. (2012) study. Available norms for the DASS-21 (Lovibond & Lovibond, 1995) indicate that the current sample of mothers had mild levels of depression and stress and moderate levels of anxiety. Mothers mean scores on the RSES are comparable to those of previous study that used this measure in a non-clinical Dutch sample (e.g., Franck, De Raedt, Barbez & Rosseel, 2008).

Based on the significance level of $p \leq 0.01$, the four dimensions of child temperament were significantly correlated with child food fussiness. Child food fussiness was positively correlated with emotionality and shyness and negatively related to activity and sociability. Mothers who reported their children as having higher emotional and shy temperaments also reported these children as being more fussy. Conversely, children reported as having lower child activity and sociability scores were reported as being more fussy. The strength of the relationships between child temperament and child food fussiness were moderate to large, as indicated by their effect sizes.

Based on the significance level of $p \leq 0.01$, there was a significant positive relationship between child food fussiness and the three dimensions of maternal psychopathology: depression, anxiety and stress, meaning that mothers who scored higher on depression, anxiety and stress reported that their children were more fussy. The strength of the relationships between maternal depression and maternal stress and child food fussiness were moderate to large while the strength of the relationship between maternal anxiety score and child food fussiness was small, as indicated by their effect sizes.

Based on the significance level of $p \leq 0.01$, five out of the seven measured dimensions of maternal core beliefs were significantly related to child food fussiness. Scores on Emotional Deprivation, Failure to achieve, Dependence, Enmeshment and Subjugation were significantly positively related to the child food fussiness, which means that mothers who scored high on these core beliefs reported their children as more fussy. The strength of the relationship between these maternal core belief variables and child food fussiness was small, as indicated by their effect sizes. Defectiveness and Abandonment were not significantly related to child food fussiness. Maternal self - esteem score was not significantly related to child food fussiness.

Of the socio-demographic variables, the positive relationships between Maternal Education (No UG degree vs. UG Degree or higher), Marital Status (Married or Living together vs. Single) and child food fussiness approached significance. Child food fussiness scores were higher in the “UG/PG Degree” category than the “No UG degree” category, indicating that mothers with a degree reported their children as more fussy. Child food fussiness scores in the “Single” were higher than those in the “Married or Living Together” category meaning that mothers who were single reported their children as more fussy. The strength of the relationship between these demographic variables and child food fussiness was small, as indicated by their effect size.

Child socio-demographic variables (sex and age) and maternal socio-demographic variables (Maternal Age and Maternal Ethnicity) were not significantly related to child food fussiness score.

Table 2-2 Two tailed bootstrapped Pearson's correlation between sociodemographic variable, EAS, DASS-21, YSQ-S, RSES and child food fussiness (N = 162)

	Median	Mean (SD)	Range	r	p	95% CI
Child socio-demographic variables						
Age of Child	3.00	3.05 (0.80)		-.012	.230	-.169 .133
Sex of Child	2.00	-		-.095	.883	-.255 .067
Maternal socio-demographic variables						
Maternal Education	1.00	-		.197*	.012	.053 .343
Maternal Ethnicity	1.00	-		-.115	.146	-.263 .034
Marital Status	0.00	-		.197*	.012	.042 .356
Maternal Age	1.00	-		-.009	.909	-.159 .141
EAS						
Emotionality	2.80	3.06 (1.37)	1 - 5	.675**	<.001	.551 .778
Activity	4.00	3.81 (1.00)	1 - 5	-.429**	<.001	-.570 -.276
Sociability	3.20	3.16 (0.98)	1 – 5	-.350**	<.001	-.518 -.160
Shyness	2.60	2.76 (1.17)	1 - 5	.371**	<.001	.190

						.529
DASS-21						
Depression	6.00	6.81 (3.31)	0 -21	.452**	<.001	.303 .590
Anxiety	4.00	7.33 (8.93)	0 -21	.337**	<.001	.196 .477
Stress	11.00	8.42 (6.88)	0 - 21	.502**	<.001	.356 .629
RSES	20.00	21.82 (5.49)	0 - 30	-.076	.339	-.256 .076
YSQ-S						
Emotional deprivation	3.00	1.61 (0.78)	1 - 6	.280**	<.001	.106 .435
Abandonment	2.00	1.47 (5.03)	1 - 6	.172*	.029	.024 .328
Defectiveness	3.00	1.15 (0.48)	1 - 6	.115	.146	-.023 .248
Failure to Achieve	2.00	1.26 (0.55)	1 - 6	.202*	.010	.059 .337
Dependence	3.00	1.40 (0.67)	1 - 6	.302**	<.001	.164 .438
Enmeshment	2.00	1.64 (0.86)	1 - 6	.214*	.006	.023 .376
Subjugation	2.00	1.63 (0.84)	1 - 6	.311**	<.001	.154 .457
CEBQ FF	3.00	3.17 (1.22)	1 - 5	-	-	-

p < 0.001, *p < 0.01

On the basis of the results of the correlation analyses, four dimensions of child temperament (EAS), three dimensions of maternal psychopathology (DASS-21) and five maternal core beliefs (YSQ) were entered into the regression analyses while controlling for maternal education and marital status. Prior to conducting the regression analyses, the contribution of individual predictors was assessed. Green (1991) recommended the simple rule of thumb of N >104 + m (where m is the number of predictors). Therefore with 14 predictors, a sample size greater than 104 + 14 = 118 will be sufficient. According to the statistical power analysis program G*Power (Faul, ErdFelder, Lang, & Buchner, 2007), with 14 predictors, a total of 135 participants is required to attain power of 0.80 assuming a medium effect size of F = 0.15 (see Appendix Z). Therefore, the final sample of 162 respondents was deemed adequate for a total of 14 predictors to be included in the analysis. An assumption of regression analysis is that all predictor variables should be continuous or categorical with only two categories (Field, 2013). The binary versions of maternal demographic variables; maternal education (No degree vs UG Degree or higher) and marital status (Married/Living Together vs Single) were therefore used in the regression analysis.

A bootstrapped four stage Hierarchical regression analyses was conducted with child food fussiness as the dependent variable. The binary maternal demographic variables; Maternal Education and Marital Status were entered first to control for the effect of demographics in the analyses. All other variables were entered in order of their importance as risk factors for the development of child food fussiness based on prior research. The four dimensions of child temperament (Emotionality, Activity, Sociability and Shyness) were assigned second entry as there is a plethora of research that has consistently established an association between several dimensions of child temperament and child food fussiness (e.g., Haycraft et al., 2011; Kagan & Snidman, 1991; Pliner & Loewen, 1997). Five maternal core beliefs (Emotional Deprivation, Failure to achieve, Dependence, Enmeshment and Subjugation) were assigned third entry while three dimensions of maternal psychopathology (Depression, Anxiety and Stress) were entered last. Although there is substantial research citing a positive relationship between maternal psychopathology and child food fussiness (e.g., Coulthard & Harris, 2003; de Barse et al., 2016), research citing links between maternal core beliefs and child food fussiness is limited. However, it was decided to enter maternal core beliefs before maternal psychopathology in this analysis as unhealthy negative core beliefs have been implicated in the development of psychopathologic symptoms such as depression and anxiety. Therefore, it seemed sensible to give maternal core beliefs precedence over maternal psychopathology.

Prior to conducting regression analysis, key assumptions for regression were checked. Multicollinearity was tested by examining the correlation matrix for correlations between the predictor variables to check for variables that correlate highly. It has been reported that correlations exceeding $r = 0.8$ or $r = 0.9$ indicate the presence of multicollinearity (Berry, 1993; Field, 2013). The present data revealed that majority of the variables were not highly correlated with the exception of stress and depression ($r = .81$) and anxiety and depression ($r = .82$). However, a more stringent test of multicollinearity required looking up the Tolerance and VIF values produced in the collinearity statistics table. Tolerance values below 0.1 (Field, 2013) and large VIF values greater than 10 (Bowerman & O'connell, 1990; Myers & Myers, 1990) indicate the presence of multicollinearity. As these values were all within acceptable limits in the present analysis, the assumption of multicollinearity was deemed to have been met. An examination of Cook's Distance values showed that there were no values above 1 which is an indication that there were no cases exerting undue influence. The Durbin-Watson test statistic (2.082) revealed no signs of linear autocorrelation while examination of the normal P-P and scatterplots showed that the assumptions of homoscedasticity and linearity were met. Independent variables were not mean centred before they were entered into the regression model. This was because the interest was in determining the prediction of food fussiness from individual independent variables and not interaction effects from the product of individual variables. In the literature, mean centering has mostly been used in moderated regression models with interaction terms where the aim is to reduce collinearity that may result from a cross-product interaction term and its constituent parts (Tabachnick & Fidell, 2007). Kraemer and Blasey (2004), support the practice of mean-centering and argued that many researchers use non-mean centred data in simple regression models as they choose not to examine interaction effects which often leads to inconsistent and misleading results. According to Kramer and Blasey (2004), this is because an interaction effect may exist in the population which would not be captured resulting in misleading statistical inferences. Echambadi and Hess (2007), on the other hand did not observe any benefits of mean-centering as they failed to find any differences between the determinants of the interaction term for mean centred and non- mean centred data. Echambadi and Hess (2007) concluded that mean centering does not mitigate collinearity problems in moderated regression models.

2.4.2 Results of Hierarchical Regression analyses

In Step 1, the maternal demographic variables; maternal education and marital status contributed significantly to the regression model, $F(2, 159) = 6.670$, $p = 0.002$. Introducing the child temperament variables (EAS) in Step 2 resulted in a significant change in R^2, $F(4, 155) = 31.698$, $p < 0.001$. The change in R^2 was also significant when the maternal core beliefs variables (YSQ-S) were added to the regression in Step 3, $F(5, 150) = 2.386$, $p = 0.041$. Finally, the introduction of maternal psychopathology variables (DASS-21) in Step 4 resulted in a trend approaching significance for the resultant change in R^2, $F(3, 147) = 2.565$, $p = 0.057$.

(See Table 2.3 for results of hierarchical regression analyses). The final model of the regression analyses revealed that child food fussiness is predicted by child temperament, specifically higher emotionality, lower activity and lower shyness. Results also revealed that food fussiness is predicted by mothers' greater time in education and mothers' lower subjugation beliefs but there was no significant influence of maternal psychopathology and other core beliefs (Table 2.4).

Table 2-3 Summary of bootstrapped Hierarchical Regression Analysis investigating the relative importance of child temperament, maternal psychopathology and maternal core beliefs in predicting child food fussiness (N = 162).

Step	**R**	**R^2**	**ΔR^2**
1. Sociodemographic variables	.278	.077	.077
2. Plus EAS	.702	.493	.415**
3. Plus YSQ-S	.728	.530	.037*
4. Plus DASS-21	.744	.553	.023

***p < 0.05; **p < 0.001*, ΔR^2= R square change**

Table 2-4 Table 2-4: Significant individual predictors of food fussiness (N = 162).

Step 4 (Final model)	B	SEB	β	95% CI
Maternal Education	.345	.147	.136*	.130 -.473
Child Temperament (EAS)				
Emotionality	.534	.076	.600**	.367 - .673
Activity	-.217	.103	-.177*	-.464 -.050
Shyness	-.273	.125	-.262*	-.528- -.008
Maternal Core Beliefs (YSQ-S)				
Subjugation beliefs	-.042	.020	-.196*	-.461 - -.0.7

p < 0.05; ** p < 0.001

Child temperament was found to be the most important predictor of child food fussiness, and on its own accounted for 49.3% of variability in child food fussiness, however the first regression analyses was not designed to establish which of the child temperament dimensions contributed. To address this, a follow-up four-Step hierarchical regression analysis was conducted to determine the relative contribution of significant child temperament dimensions in predicting child food fussiness (See Table 2.5 for regression statistics). In the first Step, Maternal education and Marital status were entered in the regression model as covariates. Emotional temperament was entered in Step 2 as research has established a consistent relationship between emotional temperament and child food fussiness. Shy and unsociable temperaments have been found to be associated with child food fussiness and was assigned third entry. Finally, activity was entered in last as it has not been found to be linked to child food fussiness.

The Hierarchical regression showed that in Step 1, maternal variables significantly contributed to the model explaining 7.7% of variance in food fussiness scores, $F(2, 159) = 6.670$, $p = 0.002$. In Step 2, emotional temperament contributed significantly to the regression model and explained an additional 38.5% of the variance in child food fussiness scores, $F(3, 158) = 45.309$, $p < 0.001$. Adding Shy temperaments in Step 3 explained an additional 1% of the variance in child food fussiness scores, however this change in R^2 was not significant, $F(5, 156) = 27.919$, $p = 0.238$. Finally, adding activity in Step 4 explained 2% of the variance in child food fussiness scores and this change in R^2 was significant, $F(6, 155) = 25.072$, $p = .014$. These results reveal that the role of temperament in child food fussiness is best primarily explained by higher emotional child temperaments.

Table 2-5 Summary of Hierarchical Regression Analysis for child temperament dimensions predicting fussy eating (N = 162).

	B	SEB	β	R	R^2
EAS				.702	.493
Emotionality	.647	.067	.720***		
Shyness	-.280	.120	-.224*		
Activity	-.265	.098	-.215**		

p <0.05; **p <0.01; ***p < 0.001

2.5 Discussion

The present study aimed to investigate the relative importance of child temperament, maternal psychopathology and maternal core beliefs in predicting maternal reports of child food fussiness in a cross-sectional sample of mothers of children aged 2-4 years. Overall, the results indicate that higher emotional temperaments, lower activity scores and lower shyness scores significantly predicted increased maternal reported food fussiness. In addition, the results also suggest that mothers' time in education and maternal subjugation beliefs significantly predicted food fussiness, with longer time in education and lower subjugation beliefs predicting greater food fussiness. Although maternal psychopathologic symptoms of depression, anxiety and stress were significantly correlated with food fussiness, they were not significant predictors of food fussiness over and above child temperament and maternal core beliefs. Specifically, higher emotional temperament in children was found to be the most important predictor of child food fussiness.

As expected, the present study found that higher emotional child temperament predicted greater child food fussiness extending previous cross sectional research linking higher emotional temperament with greater food fussiness (e.g., Powell et al., 2011; Haycraft et al., 2011). As previously highlighted in chapter one (p. 46), explanations for this link are unclear, although it has been suggested that children with higher emotional temperaments may show heightened emotional reactivity during mealtimes leading to difficult parent-child interactions and the use of counterproductive feeding practices. Emotional children's response to challenging events perceived as novel, ambiguous or frustrating has been found to include negative reactive behaviours such as intense crying and temper tantrums (Fox, 1989; Little & Carter, 2005). It is reasonable to assume that children higher in emotionality are likely to throw tantrums and engage in angry emotional outbursts during challenging events such as mealtimes which parents may perceive as some form of rebellion. This could result in difficult mealtimes and struggles resulting in parents resorting to using feeding practices such as verbal pressure and physical prompts that have previously been found to be associated with increased food fussiness as highlighted in chapter one (pp. 58-60).

Supporting the hypothesis and extending previous cross sectional research that has found a link between shy and unsociable temperament and food fussiness (e.g., Pliner & Loewen, 1997), the present study found shyness to be a significant predictor of food fussiness. However, while previous studies have reported more food fussiness in shy and timid children, the present study found that lower shy temperament scores significantly predicted increased maternal reported food fussiness. This finding is surprising as it has been suggested that a reason for the link between shyness and food fussiness is that shy children are reserved in unfamiliar situations and may extend such reservations to the acceptance of novel foods (Forestell & Mennella, 2012; Kagan & Snidman, 1991). However, it is also possible that children who are less shy may be unreserved and less hesitant in indicating their likes and dislikes during mealtimes and this greater willingness to express their preferences may have resulted in increased maternal perception of food fussiness. Contrary results may be attributed to the different ages of children sampled in the present study and previous studies that have found an association between shyness and food fussiness. In the present study, lower levels of shy temperament predicted food fussiness in early childhood while Pliner and Loewen(1997) found greater levels of shyness to be associated with food fussiness in mid to late childhood. Further research especially in early childhood where food fussiness first becomes apparent is needed to shed more light on the association between food fussiness and shy temperament. Such research could explore the personality traits of fussy eaters who are less shy to determine if such children are stronger willed which would explain their willingness to express their preferences and to be more likely to engage in struggles resulting in increased maternal perception of food fussiness. This could be an observational study with groups of shy versus less shy children to explore differences in their persistence and determination across several situations. Alternatively, mothers could be asked to complete personality assessment questionnaires to determine the personality traits of fussy eaters who are less shy.

The present study found that lower activity scores significantly predicted increased maternal -reported food fussiness. Activity has been described as high levels of activity and speed at performing various actions (Goldsmith et al., 1987). Typical measures are the rate and amplitude of speaking, moving, displacement of body movements and duration of energetic behaviour (Goldsmith et al., 1987). Individuals high on activity tend to perform actions at a fast pace and may require considerable energy expenditure while those low on activity have a preference for a slower pace and expend lower energy (Buss & Plomin, 1984). To our knowledge, no prior research exists assessing this dimension of child temperament in relation to food fussiness. To explain the present finding, it is possible that children low on activity may approach mealtimes at a slow pace resulting in lengthened feeding times which mothers could perceive as indicative of food fussiness. A recent finding from Singapore (Goh & Jacob, 2012) where parents perceived their children’s slow eating during mealtimes as a common typical feature of food fussiness supports this argument.

Consistent with previous research linking maternal psychopathologic symptoms of depression and anxiety with child food fussiness (e.g., Blissett et al., 2007; Coulthard & Harris, 2003), the present study found maternal depression, anxiety and stress to be significantly related to maternal reported child food fussiness. However, maternal depression, anxiety and stress did not predict food fussiness after child temperament and maternal core beliefs were controlled for. As child temperament accounted for most of the variability in food fussiness scores, it may be that the positive relationship between maternal psychopathology and food fussiness exists because of child temperament. It is also possible that previous studies that have reported a relationship between maternal psychopathology and food fussiness (e.g., Blissett et al., 2007; Coulthard & Harris, 2003; de Barse et al., 2016) observed this link because they did not measure child temperament.

Although maternal unhealthy core beliefs of emotional deprivation, abandonment, failure to achieve, dependence/incompetence, enmeshment and subjugation contributed to the regression model to predict maternal reported child food fussiness, only subjugation beliefs individually predicted food fussiness. As previously described in Chapter one (p. 53), subjugation beliefs involve the giving up of control to others due to feelings of being pressured. Previous research has reported an association between this dimension of maternal core beliefs and food fussiness, with higher levels of subjugation beliefs significantly correlated with maternal reports of child food fussiness (e.g., Blissett et al., 2005). Interpretations of this finding propose that those high on subjugation beliefs give up control of significant decisions/choices to others due to perceived feelings of powerlessness and of being pressured which may lead to the failure to use adaptive problem solving strategies when faced with their child's eating problem (Blissett et al., 2005). In the present study, the direction of the relationship between subjugation beliefs and children's food fussiness was contrary to that found in previous studies with mothers who had lower subjugation beliefs, meaning they were less likely to relinquish control or succumb to pressure, reporting increased child food fussiness. It has been suggested that food fussiness may be an attempt by children to assert some independence in their food choices (Dovey et al., 2008). A possible explanation of these findings is that mothers with lower levels of subjugation beliefs may find their child's attempt to control their food intake challenging and may have a heightened perception of their child's food fussiness while mothers with lower levels of subjugation beliefs are likely to use controlling feeding strategies in an attempt to curb their child's food fussiness. Given that controlling feeding strategies have been implicated in the development and reinforcement of food fussiness (e.g., Fisher et al., 2002; Wardle et al., 2005), the use of such strategies may result in increased food fussiness, therefore increased maternal perception of child food fussiness.

In the present study, higher maternal education predicted greater child food fussiness. This is similar to the findings of Emmett, Hays, and Taylor (2018) where higher maternal educational attainment was positively associated with greater maternal perception of child food fussiness. An explanation for this finding may be that higher levels of education may provide mothers with more knowledge about adequate child nutrition and may lead to a heightened awareness of their child's limited diet resulting in a higher perception of food fussiness. It is also plausible that more educated mothers may be more worried about their child's limited diet and the potential risk of illness and may be more inclined to use more controlling feeding practices to address food fussiness, further exacerbating the feeding problem resulting in an increased perception of food fussiness. Research citing a link between maternal education and controlling feeding strategies lends support to this argument. For example, Saxton, Carnell, van Jaarsveld, and Wardle (2009) found that highly educated mothers reported using more control over their children's food intake. Similarly, qualitative studies of lower educated mothers report low levels of control over their children's food intake (Jain et al., 2001; Kaiser, Melgar-Quinonez, Lamp, Johns, & Harwood, 2001).

A strength of this study was the inclusion of child and maternal factors together in a single analysis which permitted the investigation of the relative strength of association between these factors and child food fussiness in early childhood; an age where food fussiness is most prevalent. Another strength of this study lies in the use of Food Fussiness (FF) subscale of the CEBQ to assess child food fussiness which has been behaviourally validated by independent observations of children's eating and found to accurately reflect maternal reported food fussiness (e.g., Fernandez et al., 2018).

There are several limitations to this study. White British mothers were the most predominant ethnic group, and the need to dichotomise variables resulted in the analysis distinguishing between “White British” and “other ethnicity”. Thus, the generalisability of the study findings is restricted. Future research exploring potential child and parent risk factors for the development of food fussiness in other ethnic groups is recommended. There is also the issue of sampling bias as there is an over representation of mothers recruited from mother and toddler groups. Mothers at these groups tended to be of a similar age-group and background and may have possessed similar characteristics, therefore are not a representative sample of the population. Another limitation lies in the cross-sectional nature of this study which prevents causality from being inferred. While the present study identified several child and maternal potential risk factors for the development of food fussiness, it is not clear whether they are a cause or consequence of child food fussiness. Future longitudinal research allowing for the exploration of causation could help shed light on the direction of this relationship. The cross-sectional design also captures the prediction of child food fussiness at a specific point in time and it is unclear if identified significant correlates will remain potential risk factors for the development of food fussiness over the course of time. Longer term studies will help assess the effects of child and maternal factors on food fussiness as time progresses. An ideal research study could assess maternal and child factors as well as food fussiness at several time points, for instance from birth to mid childhood. Child temperament, maternal psychopathology and maternal core beliefs and child food fussiness could be assessed at birth (Time point 1), at age 2 where there is a reported increase in parents perception of food fussiness (Time point 2) and finally at age 6 where there is reported decline in parents perception of food fussiness (Time point 3) to determine the contributing effects of these child and maternal factors to the development of food fussiness at these time points.

2.6 Conclusion

This study’s findings highlight the importance of higher emotional tempera in children’s food fussiness. Collectively, these findings emphasize that when considered alongside other child temperament dimensions, maternal anxiety, depressive and stress symptoms and maternal cognition, emotional temperament emerged as the strongest predictor of food fussiness in children aged 2-4 years. This finding advances our understanding of food fussiness as child and maternal characteristics were examined in relation to fussy eating in an age-group associated with increased parental perception of food fussiness, therefore interventions aimed at addressing food fussiness could target higher emotional temperaments in children. Although this study highlights an association between emotional child temperaments and food fussiness, explanations for this relationship are unclear and such knowledge could better guide the development of potential future interventions to address food fussiness. Further research investigating how emotional temperaments interacts with other previously identified correlates and risk factors of food fussiness to influence fussy eating is needed.

Chapter 3: Behavioural validation of a parent-report measure of food-fussiness in children

3.1 Abstract

Food fussiness is the rejection of familiar and novel foods leading to consumption that is insufficient and/or inadequately varied. To measure food fussiness, research has predominantly relied on the use of parent-report, which can be subjective and produce biased responses. Validating parent-report questionnaires against independent observations of children's eating behaviour will provide important insights into the accuracy of such questionnaires. The aim of the present study was to validate maternal reported food fussiness as assessed using the food fussiness subscale of the CEBQ (Wardle et al., 2001) against observed child food rejection and acceptance behaviours during a recorded mealtime in the home environment. Sixty-seven mother-child dyads were video-recorded during a mealtime. Bootstrapped Pearson's correlations revealed that maternal reports of food fussiness were significantly positively related to food rejection behaviours and significantly negatively related to food acceptance behaviours. Maternal reports of food fussiness were also found to be significantly negatively related to the proportion of familiar foods consumed by the child. There was no significant association between maternal reported food fussiness and the proportion of unfamiliar foods consumed by the child or meal duration.

3.2 Introduction

The literature reviewed in Chapter one (pp. 3-8) highlighted that research on food fussiness has predominantly relied on the use of parent report questionnaires to measure child food fussiness (Carruth et al., 1998; Galloway et al., 2005, 2003; Hafstad et al., 2013). The cost effectiveness and ease with which they can be administered on a large scale makes the use of parent-report questionnaires advantageous (Carnell & Wardle, 2007). However, as previously discussed in Chapter one (p. 8), instances of biased responses and inconsistent responses associated with parent-report (e.g., Boquin, Moskowitz, Donovan, & Lee, 2014) cast doubt on the reliability of this approach. Although evidence suggests that parents can be reliable informants of their children's eating behaviour (e.g., Cooper et al., 2004), research validating parent- report against independent observations of children's eating behaviour is crucial to comprehensively evaluate reliability.

To date, research examining the quality of parent-report of child eating behaviours has typically focused on determining internal validity (whether the items on a measure are inter-correlated), concurrent validity (whether scores obtained from one measure correlate with scores obtained from a similar measure), face validity (the extent to which the questions on a measure cover the concepts it purports to measure) and test-retest reliability (response over multiple test situations is stable) (Carnell & Wardle, 2007). Few studies have used the method of behavioural validation, examining whether parent-report of child food fussiness via a questionnaire aligns with observations of child mealtime behaviour and dietary intake, to determine the reliability of parent-report of food fussiness. This can be attributed to the cost, labour-intensiveness and complexity involved in collecting observational data (Byrne et al., 2016).

The Food Fussiness subscale of the CEBQ (Wardle et al., 2001) is a widely used parent-report questionnaire that has been used for assessing food fussiness in young children (e.g., Fernandez et al., 2018; Fries et al., 2017; Hendy, Williams, Riegel, & Paul, 2010; Jansen et al., 2012; Tharner et al., 2015; Werthmann et al., 2015). As previously discussed in Chapter one (pp. 7), The FF scale has been shown to accurately discriminate between fussy and non-fussy eaters, categorised using a structured psychiatric interview (Steinbekk et al., 2017). The FF subscale has also been found to show good criterion validity with the Montreal Children's Hospital Feeding Scale (MCHFS; Ramsay et al., 2011), another measure of children's feeding problems (Rogers et al., 2018). These methods, however relied on parent report to measure children's food fussiness and other child eating behaviours which is subject to bias. Behavioural validation of several scales of the CEBQ, e.g. Food Responsiveness (FR), Enjoyment of Food (EF) and Satiety Responsiveness (SR) have revealed significant correlations between behavioural measures of children's eating and parent responses on these subscales (Carnell & Wardle, 2007). Few studies have examined the relationship between parent-reported food fussiness measured by the Food Fussiness (FF) subscale of the CEBQ and observed food fussiness in children. As discussed in Chapter one (pp. 10 - 14), studies that have done so are limited by the use of artificial testing environments (e.g., Werthmann et al., 2015; Fernandez et al., 2018), limited food choice (e.g., Fernandez et al., 2018) and by parent bias in the choice of food offered to their children (e.g., Fries et al., 2017).

While the FF subscale of the CEBQ is already broadly validated, the present study aimed to address the weakness of existing studies. Addressing the limitations of previous research that have assessed children in a laboratory environment (e.g., Werthmann et al., 2015; Fernandez et al., 2018), the present study observed children eating a meal in the presence of a parent in their home environment. Researchers selected the components of the meal to ensure it comprised both unfamiliar and familiar food (based on information from mothers) to limit parent bias that might arise if parents were solely responsible for children's food choice (e.g., Fries et al., 2017). Children were given age-appropriate portion sizes and mothers were asked to behave in the way they usually would when providing their child with a meal. The objective of the present study was to validate maternal-report of child food fussiness by examining the relationship between maternal-report scores on the food fussiness subscale of the CEBQ and independent observations of food rejection and acceptance behaviours during a video-recorded mealtime.

The following hypotheses were tested:

1. Maternal-reported food fussiness will closely correspond to observed food rejection and acceptance behaviours during the mealtime, specifically, higher scores on the Food Fussiness subscale of the CEBQ will be associated with more observed food rejection behaviours and with fewer observed food acceptance behaviours during the recorded mealtime.
2. Higher scores on the Food Fussiness subscale will be associated with smaller proportions of familiar and unfamiliar foods consumed by the child during the recorded mealtime.
3. Higher scores on the Food Fussiness subscale will be associated with longer meal duration.

3.3 Method

This study was approved by the University of Reading's Research Ethics Committee (UREC 15/43/KH).

3.3.1 Design

In this within-subjects study, children were provided with a meal comprising familiar and unfamiliar food items and foods that they were likely to find appealing and unappealing. Each child's meal was tailored according to his/her mother's responses regarding foods categorised into the following groups: (i) familiar/appealing (ii) familiar/unappealing (iii) unfamiliar/appealing and (iv) unfamiliar/unappealing.

3.3.2 Participants

Participants included sixty-seven children and their mothers recruited from the University of Reading Child Development Group Database as described in detail below. The mean age of the children was 3.27 years (S.D = 0.69, range = 2-4 years) and the sample consisted of 39 girls and 28 boys. The mean age of the mothers was 36.3 years (S.D = 4.66, range = 22-45 years). Mothers were generally highly educated (65.7% had an undergraduate or postgraduate degree). The majority of mothers described themselves as white British (80.6%) assessed using the Office of Population Censuses and Surveys (OPCS; 2003) ethnicity classifications and were living with their spouse/partner (92.5%). (See Table 3.1 for participant characteristics). Children were included if they were typically developing and aged 2-4 years. Because the food items selected for the mealtime observation could contain nuts and dairy, children were excluded if their mother reported diagnosed nut allergies or lactose intolerance. Likewise, children with developmental disorders may have unusual eating habits due to motor problems and/or sensory difficulties and so children were excluded if their mothers reported atypical development or failure to meet developmental milestones.

Table 3-1 Study 2 Participant Characteristics (N = 67).

Mean child age in years (SD)	3.27 (0.69)
Child Sex	
Male	28 (41.8%)
Female	39 (58.2%)
Mean maternal age in years (SD)	36.3 (4.66)
Maternal Education	
Completed secondary school	23 (34.3%)
Undergraduate degree	24 (35.8%)
Postgraduate degree	20 (29.9%)
Maternal ethnicity	
White British	54 (80.6%)
White Irish	1 (1.5%)
White other	7 (10.4%)
Black Caribbean	1 (1.5%)
Black African	1 (1.5%)
Mixed (Black African/ White)	1 (1.5%)
Asian Pakistan	1 (1.5%)
Other ethnic group	1 (1.5%)
Marital status	
Single	5 (7.5%)
Living with spouse/partner	62 (92.5%)

3.3.3 Materials

3.3.3.1 CEBQ - Fussiness subscale (Wardle et al., 2001) - Appendix E

The food fussiness subscale of The Children's Eating Behaviour Questionnaire (CEBQ; Wardle et al., 2001) described in detail in chapter two (pp. 96-97), was used to assess children's food fussiness. In the present study, Cronbach's alpha for food fussiness was 0.94.

3.3.3.2 Sociodemographic variables – Appendix L

This questionnaire asked for background information about the child's age and gender (male or female) as well as the information about the mother's ethnicity, marital status, education and age. Maternal ethnicity was evaluated using the Office of Population Censuses and Surveys (OPCS; 2003) 17 group ethnic classification which combines ethnic and national group dimensions (e.g. White Irish, Black African, Asian Pakistan). Marital status was assessed using three categories (single, living with spouse/partner and not living with spouse/partner. These categories indicate whether individuals are living with their partner or not irrespective of their legal marital status. Maternal educational categories were based on three stages of education in England; primary, secondary and tertiary education. Mothers were asked to indicate their age.

3.3.3.3 Food Items selected for the mealtime observation

Children's meals were created to represent a typical meal and included soup, fruit/vegetables, bread and pudding. Food items to be included in the mealtime observation were selected based on the characteristics of foods reported by parents of fussy eaters as being consistently avoided or preferred by fussy eaters (Boquin, Smith-Simpson, Donovan, & Lee, 2014). Characteristics of foods found to be unappealing to fussy eaters include foods with slippery and mushy textures, foods with sour and bitter tastes, food with strong aromas, mixed foods with complex ingredients, soups and most vegetables. Foods that appeal to fussy eaters were found to be sweet, crunchy, salty or have bland and simple flavours. These include desserts, milk, pastries and sweet fruits. A list of possible foods with these characteristics, that were also easy to prepare in a standardized way, was created (see Table 3.2 below). Foods for each child were then selected from the list in consultation with mothers in order to create a meal tailored to each child that comprised foods representing each of the four researcher-defined categories (familiar/appealing, familiar/unappealing, unfamiliar/appealing and unfamiliar/unappealing).

Table 3-2 List of food items selected for the mealtime observation.

Soups	**Wholegrain Breads**
Sainsbury's Thai beetroot soup	Tesco Rye Bread
Sainsbury's Petits pois and ham soup	Hovis Country Granary Bread
Sainsbury's lentil dahl soup	Tesco Walnut Loaf
Desserts	**Fruits and Vegetables**
Tesco free crème caramel dessert	Grapes
Sainsbury's mango and coconut panna cotta	Pears
Tesco custard tarts	Gooseberry
Waitrose pistachio flavour macaroons	Carrots
Tesco profiteroles	Sweetcorn
Asda Kulfi-ice pistachio ice cream	Avocado

Figure 3-1 Examples of some images depicting food items.

Lentil Dahl Soup **Custard Tarts** **Rye bread** **Avocado**

3.3.4 Procedure

3.3.4.1 Recruitment

Children were recruited from the University of Reading Child Development Group Database which contains the details of over 2000 families with children in this age group. The majority of the children on the database were recruited shortly after birth from the Royal Berkshire Hospital. Mothers staying at the maternity wards of the Royal Berkshire Hospital are invited to participate in future psychological research by recruiters from the University of Reading, and those who express an interest are added to the database. Mothers on the database were contacted by the researcher either via email or telephone and given a brief overview of the study as well as the inclusion/exclusion criteria (See Appendix M for telephone interview). 89 mothers of typically developing children aged 2-4 who did not confirm any diagnoses of nut allergies or lactose intolerance in their child consented to participate and provided an email address to receive an online questionnaire link. Within this link, mothers were provided with a written information sheet detailing all aspects of the study and consent was sought before completion of all questionnaires (See Appendix N for parent information sheet and Appendix O for consent form). Mothers were asked to complete the Food Fussiness questionnaire and to provide demographic information. Mothers were also provided with a food checklist (See Appendix P) and images depicting each food (e.g., Figure 3.1). Mothers were asked to indicate for each food whether their child was likely to find the food familiar and appealing to their child, familiar and unappealing, unfamiliar and appealing or unfamiliar and unappealing. Asking mothers to indicate foods that were familiar, unfamiliar, liked and disliked by their children was to ensure that children were provided with a variety of both liked and disliked, familiar and unfamiliar foods. The questionnaires were ordered such that mothers completed the CEBQ before the food checklist. This was done to avoid priming effects as completing the food checklist first may have influenced mothers' perception of their child's food fussiness. Upon completion of the questionnaire, mothers were informed that they would be contacted by the researcher to arrange a convenient date for a home visit. When mothers were subsequently contacted and a date for the home visit had been confirmed, they were informed of the food items that the researcher would be bringing for the child's lunch (based on their responses on the food checklist). For each child, one food choice was selected for each food category (familiar and appealing, familiar and unappealing, unfamiliar and appealing or unfamiliar and unappealing). The researcher explained to mothers that their child needed to be observed eating the meal without the influence of family members eating at the same time and were asked to select a meal that would be convenient; either lunch or tea. Mothers were asked not to feed their children for two hours prior to the meal with the aim of controlling for hunger. Of the 89 mothers who completed the online questionnaire, 67 took part in the mealtime observation. For ethical reasons, mothers were not required to explain non-participation in the observational study, but those who chose to do so typically gave reasons such as their child being ill or lack of time due to having other commitments therefore being unable to arrange a convenient date and time for a home visit. G*Power 3 (Faul et al., 2007) was used to determine that the final sample of 67 participants was sufficient to meet Cohen's (1992) power recommendation and yield statistical β power of more than 0.80 (based on $\alpha = 0.05$) and to detect medium correlational effects ($r = 0.33$) (see Appendix Z).

3.3.4.2 Mealtime Observation

Children were observed in their homes during a typical mealtime. On arrival, following greetings, the researcher showed the mother the food items to be prepared for the child and assisted the mother in the meal preparation. Each child was provided with a meal comprising four food items two of which were familiar (appealing and un-appealing) and two of which were unfamiliar (appealing and unappealing). An example of a meal might be 100g lentil dahl soup (unfamiliar and unappealing), one slice gran-ary bread equivalent to 38g (familiar and unappealing), 16 seedless green grapes equivalent to 75g (familiar and appealing) and half a custard tart equivalent to 80g (unfamiliar and appealing) totalling about 420 kcal. To determine the proportion of food that the child had consumed, each portion of food was weighed by the re-searcher using a Salter digital kitchen weighing scale before it was placed on the child's plate and any leftovers were weighed by the researcher after the child had finished eating. Mothers were asked to refrain from tasting the foods during the mealtime as this would prevent an accurate measurement of the food the child had consumed. A video camera was used to capture the child's eating behaviour during the session which was placed on a tripod and positioned in the dining area. To avoid social desira-bility effects, where the child might be inclined behave differently because of the video camera, the camera was set up about 15-20 minutes prior to the meal and the researcher made conversation with the child with the intention of familiarising him/her to both the researcher and the video camera. During this time, the child was shown an age appropriate information sheet in the form of cartoon images depicting the stages of the mealtime observation. The researcher explained to the child that they were first going to play a game that would be video recorded, thus explaining the presence of the camera. The game took place where the child would later eat his/her meal and involved a children's card game called "tummy ache". The researcher played this game with the child and the mother until the child felt at ease and was comforta-ble playing with the researcher alone at which point the mother took the opportunity to leave and prepare the child's meal. If the child was unwilling to play the game or too young to comprehend the game, he/she was invited to do a drawing of their favourite meal or indicate their favourite foods from the pack of cards. When the food had been prepared, the mother placed it on the table and invited the child to eat. The researcher took this cue to leave the mealtime environment either leaving the house or waiting in an adjacent room if one was available. This was to ensure the mealtime was as typical as possible. Mothers were asked to behave as they usually would during a typical mealtime, for example, some mothers may be inclined to use some form of encouragement to eat. However, to ensure uniformity of meals between participants, mothers were asked not to add any condiments to the meal such as butter, ketchup, cheese. The researcher asked mothers to let her know when the child had finished eating. This indicated the end of the mealtime observation and the researcher stopped the video recording. Children were given stickers and thanked for participating while mothers were provided with a debrief of the study (Appendix Q) and thanked for their participation.

3.3.4.3 Coding of Eating Behaviour

Video recordings of mealtimes were coded offline by the researcher using the Observer XT9 Software (http://www.noldus.com/human-behaviourresearch/products/theobserver-xt-90). Behavioural measures of food fussiness were obtained from previous literature (e.g.,Fries et al., 2017; Klesges et al., 1983; Luchini, Lee, & Donovan, 2016; Timimi et al., 1997) which lists several mealtime behaviours that have been found to be associated with fussy eaters (See Table 3.3). A coding scheme was created which included a detailed description of the behaviours to be coded from the video recordings (See Appendix R). Each behaviour was assigned a keyboard key and every time a particular behaviour was observed, it was scored by pressing the corresponding keyboard key. A second coder was trained by the researcher to correctly identify child behaviours from the videos using the defined coding scheme. The second coder was trained until interrater reliability (calculated using the Observer XT9 software interrater reliability function) showed a 90% agreement between coders (Cohens $k = 0.896$, $p < 0.01$). (Stein et al., 2001) proposed that raw data percentage agreements exceeding 75% indicate an acceptable level of reliability. The second coder subsequently coded 25% of the videos with the percentage agreement between coders ranging from 79 - 92%, an indication that coding achieved a high reliability.

Table 3-3 List of behaviours coded from the mealtime observation.

Observed Mealtime Behaviours	**Description of Behaviour (References)**
Food Refusal	The child refuses the presented food by pushing the food away, turning their head away when the food is presented by the parent or by verbally refusing to try the food.[7]
Spitting food	The child places the food in their mouth and spits it out or vomits. [1, 3, 5, 9, 10]
Playing with food	The child plays with food by messing, stirring, throwing and crumbling the food or treating the food as well as the utensils as a toy but does not consume the food. [2, 3, 8]
Licking food	The child licks the presented food but does not consume it. [8, 9]
Touching food	The child touches the presented food but does not consume it. [8, 9]
Smelling food followed by rejection	(See below).
Child Positive food comments	Positive sounds and comments the child expresses towards the presented food, e.g. "I like this", "this tastes nice", and "yum!"
Child negative food comments	Negative sounds and comments the child expresses towards the presented food. This includes complaints and expressions of disgust, e.g. "this tastes disgusting", "Yuk!"[9]
Food consumption	The child consumes the presented food; putting food in the mouth and swallowing it [4, 6, 8].
Use of Pressure	These are verbal encouragements to get the child to consume the presented food. Verbal encouragement

	may include statements such as "try a bit more" or "eat two more mouthfuls".
Use of physical prompts	These are physical encouragements by the mother to get the child to consume the presented food usually by offering the food to the child. This may include placing food on a spoon/fork and offering it to the child or putting the food on the spoon/fork ready for the child to pick up.
Use of non-food rewards	These involve mother's use of non-food rewards to encourage food consumption by the child. This may include promising the child a favourite toy, stickers, visiting a favourite place or the chance to play a favourite game in return for trying the presented food.
Use of food rewards	These involve mother's use of food rewards to encourage food consumption by the child. This may include promising the child a favourite food for trying the presented food.

Note: Previous studies that have cited the above mealtime behaviours associated with food fussiness.

1. Klesges et al. (1983); 2. Sanders et al. (1993); 3. Timimi et al. (1997); 4. Jacobi et al. (2003); 5. Lewinsohn et al. (2005); 6. Galloway et al. (2005); 7. Dovey et al. (2008); 8. Boquin, Smith-Simpson, Donovan and Lee (2014); 9. Luchini et al. (2016); 10. Fries et al. (2017).

Few studies have investigated the prevalence of smelling food towards the presentation of novel foods as a mealtime behaviour. Two that do report a low occurrence of this behaviour in children aged 12-48 months (Blissett, Bennett, Donohoe, Rogers, & Higgs, 2012; Johnson, Bellows, Beckstrom, & Anderson, 2007) and a further, third study found smelling food during a meal was not associated with parent reported food fussiness in children aged 12-35 months (Momin et al., 2018). Therefore, this study did not intend to measure "smelling food". However, during initial coding of the video recordings researchers observed smelling food on several occasions, and it was decided this behaviour should also be coded. Two distinct behaviours relating to smelling food were observed: smelling immediately followed by food rejection; and smelling immediately followed by food consumption. In the majority of instances smelling was followed by rejection (65%), and therefore analysis focused on this specific smelling behaviour.

Several studies have found fussy eaters take longer to eat than non-fussy eaters (Reau et al., 1996; Timimi et al., 1997). Therefore, in addition to coding specific eating behaviours, meal duration was calculated for each child as the total time (minutes) from when the child was invited to eat through to when the parent indicated the child had finished eating. Finally, the proportion of familiar and unfamiliar foods eaten by the child was calculated by determining the amount (grams) of food eaten within these categories relative to the total amount of familiar and unfamiliar foods offered.

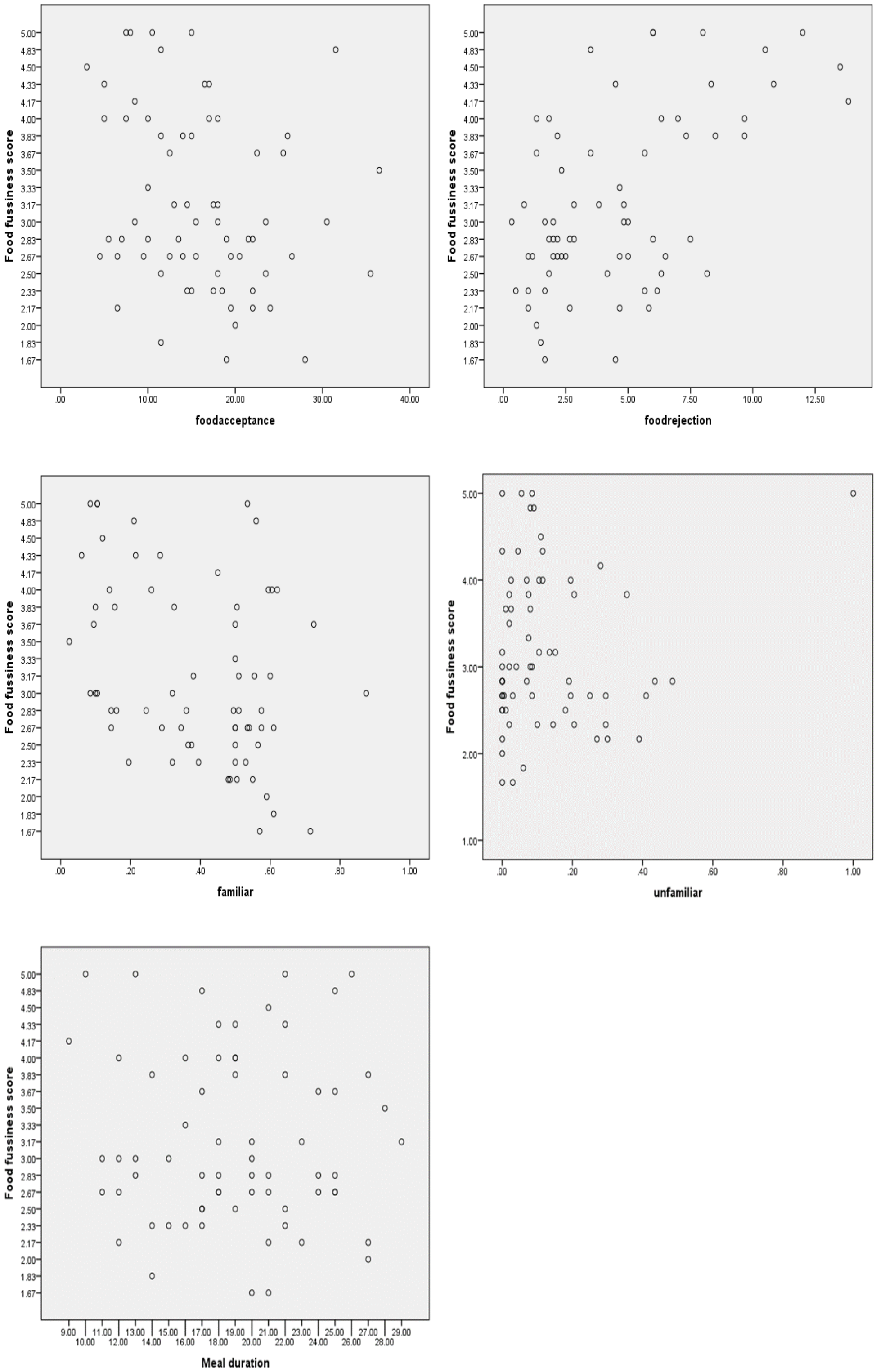
3.3.4.4 Data Analysis

Data was analysed using Statistical Package for Social Sciences (SPSS), version 23. An initial check on the accuracy of data entry showed that the minimum and maximum values of all the study variables were within the expected range. Descriptive statistics for observed mealtime behaviours, proportion of familiar and unfamiliar foods consumed, meal duration and food fussiness are shown in Table 3.4. The data set did not contain any missing data points or outliers. An examination of the normal probability plot and the histogram showed that the study variables were skewed and not normally distributed. Significant Shapiro-Wilk's tests for normality on all variables further confirmed the violation of the assumption of normality making the data set unsuitable for parametric analysis. The distribution of the variables were not improved using log, reciprocal or square root transformations, therefore a bootstrapping procedure to generate a 95% bias- corrected bootstrapped confidence intervals of the correlation coefficients (1000 samples, N = 67) was performed to investigate associations between maternal reports of child food fussiness and observed mealtime behaviours, proportion of familiar and unfamiliar foods consumed and meal duration.

Table 3-4 Descriptive Statistics for Study 2 variables (N = 67)

	Median	Mean (SD)	Range	Fre-quency
CEBQ FF score	3.00	3.19 (0.89)	1 -5	-
Food refusal	6.00	8.13 (5.57)	1 - 22	545
Spitting food	0.00	2.03 (3.48)	0 - 16	136
Playing with food	0.00	1.86 (3.21)	0 - 15	125
Licking food	2.00	2.33 (2.26)	0 - 9	156
Touching food	4.00	3.95 (3.42)	0 - 16	265
Smelling food followed by rejection	1.00	1.46 (1.31)	0 - 5	98
Child negative food comments	4.00	6.58 (5.46)	0 - 21	441
Food consumption	25.00	26.6 (12.99)	5 - 66	1783
Child positive food comments	5.00	5.57 (4.21)	0 - 17	373
Maternal positive food comments	5.00	6.34 (5.79)	0 - 25	63
Maternal negative food comments	0.00	0.029 (0.17)	0 - 2	2.00
Proportion of familiar foods con-sumed	0.48	0.69 (0.41)	0.85	-
Proportion of unfamiliar foods con-sumed	0.21	0.28 (0.24)	1.00	-
Meal duration	19.00	19.03 (4.85)	20.00	-

Figure 3-2 Scatterplots showing association between food fussiness and observed behaviour variables.



3.3.4.5 Recoding of child and maternal sociodemographic variables

Prior to investigating the relationship between maternal reported food fussiness and observed mealtime behaviours, initial bootstrapped two-tailed Pearson's correlation analyses were conducted to explore associations between child and maternal sociodemographic variables, observed mealtime behaviours and food fussiness. Sociodemographic variables with more than two categories were recoded into dichotomous variables to meet the assumption of correlation analyses which specifies that two measured variables are continuous or one of the variables is categorical with two categories only.

Maternal ethnicity was re-coded into White British vs. Other (non-White-British). The majority of mothers were White British, so this represented one category while other ethnic groups, all of which contained relatively few participants, were combined to form a second category labelled "Other Ethnicity". "Other Ethnicity" was coded as 0 while "White British" was coded as 1.

Maternal Education was re-coded into No UG Degree vs. UG Degree or higher. Mothers with secondary school education represented "No UG Degree" while mothers with undergraduate and postgraduate degrees represented "UG Degree or higher". "No UG Degree" was coded as 0 while "UG Degree or higher" was coded as 1.

None of the sociodemographic variables were correlated with either food fussiness or mealtime behaviours and were not included in further analyses.

3.3.4.6 Combining Behaviours

Preliminary correlation analyses were performed to investigate associations between observed mealtime behaviours (Table 3.5). Results indicated that majority of the mealtime observations associated with food rejection and avoidance i.e. food refusal, spitting food, playing with food, licking food, touching food and child negative food comments were all significantly positively correlated. The exception was smelling food followed by rejection, which was only significantly positively related to food refusal, touching food and spitting food but not to playing with food, licking food, touching food and child negative food comments. However, like the majority of the behaviours associated with food rejection and avoidance, smelling food followed by rejection was significantly negatively related to mealtime behaviours associated with food acceptance. It was therefore decided to include smelling followed by food rejection as food rejection mealtime behaviour. The results also indicated a significant positive relationship between the mealtime behaviours associated with food acceptance i.e. food consumption and child positive food comments. To reduce the number of variables in the final correlational analysis and the associated risk of type 1 errors, it was decided to combine behaviours associated with food rejection and acceptance into single variables. As these behaviours were all frequency scores, the mean score of food rejection behaviours were computed to create a single variable labelled "food rejection". Similarly, the mean score of food consumption and child positive food comments was also computed to create a single "food acceptance" variable. This classification was performed to align with the structure of the Food Fussiness subscale of the CEBQ, which aims to characterise food fussiness with items relating to food rejection (e.g. "my child refuses new foods at first") as well as food acceptance (e.g. "my child enjoys tasting new foods"). It was also decided not to examine the effects of appealing and unappealing foods on children's eating behaviours as the appealing/unappealing was deemed subjective and not reliable. Mothers categorised foods into those that may appeal to their child and those that may be unappealing based on their knowledge of their children's experience with prior foods. Many mothers categorised foods as unfamiliar/appealing or unfamiliar/unappealing and were surprised when their child either refused or accepted these foods during the mealtime. For example, many mothers categorised walnut loaf as unfamiliar and unappealing because their children would find bread with "bits" in them unappealing based on prior experience with seeded bread. During the recorded mealtime, however, these mothers expressed surprise that their children did indeed find walnut loaf appealing as the child made positive comments about the food and consumed it. The proportion of familiar/appealing and familiar/unappealing foods consumed categories were collapsed into a single category (proportion of familiar foods consumed) by computing the mean score. Similarly, the proportion of unfamiliar/appealing and unfamiliar/unappealing foods consumed were collapsed by computing the mean to give the proportion of unfamiliar foods consumed. Again, this classification was performed to align with the definition of food fussiness which is the rejection of both familiar and unfamiliar foods.

Table 3-5 Two tailed bootstrapped Pearson's correlations between observed mealtime behaviours

	Food Refusal	Spitting food	Playing with food	Licking Food	Touching food	Smelling food followed by rejection	Child negative food comments	Maternal positive comments	Maternal negative comments	Food Consumption	Child positive food comments
Food refusal											
Spitting food	.590**										
Playing with food	.537**	.709**									
Licking food	.433**	.483**	.476**								
Touching food	.605**	.268*	.308*	.251*							
Smelling food followed by rejection	.307*	.423*	.215	.237	.269*						
Child negative food comments	.633**	.563**	.543**	.321*	.670**	.129					
Maternal positive food comments	.363*	.332*	.421**	.489	.438**	-.005	.581**				
Maternal negative food comments	-.068	-.103	-.103	.013	-.179	.005	-.132	-.194			
Food Consumption	-438**	-.479**	- .360**	-.280*	-.039	-.333*	-.349**	-.109	-.049		
Child positive food comments	-.134	-.209	-.065	-.255*	.013	-.357**	.135	.304*	-.045	.352**	
p < 0.05, **p < 0.001											

3.4 Results

Descriptive statistics for the study variables are shown in Table 3.4 above. Mean scores on the CEBQ FF subscale for children in this sample are similar to the mean scores obtained from children in Study 1 and to a previous Dutch study that has used this measure with a similar age group (e.g., Debarse et al., 2016).

Bootstrapped Pearson's correlation analyses revealed that maternal report of food fussiness was significantly positively correlated to food rejection behaviours, $r = .567$ $p < 0.001$. Children perceived by their mothers as being more fussy were observed to display more food rejection behaviours. Maternal reports of food fussiness were significantly negatively correlated to food acceptance behaviours, $r = -.244$, $p = 0.023$. Children perceived by their mothers as being more fussy were observed to display fewer food acceptance behaviours. Maternal reports of food fussiness were significantly negatively correlated to the proportion of familiar foods consumed by the child, $r = -.379$, $p < 0.001$. Children perceived by their mothers as being more fussy consumed smaller proportions of familiar foods. There was no significant correlation between maternal reported food fussiness and the proportion of unfamiliar foods consumed by the child. The correlation between maternal reported food fussiness and meal duration was also not significant (See Table 3.6 for all confidence interval values).

Table 3-6 Bootstrapped one-tailed Pearson's Correlations between maternal reports of food fussiness and observed mealtime behaviours. (N = 67).

Mealtime Behaviour	**r**	**CI$^{95\%}$**
Food Rejection	.567**	.405 - .706
Food Acceptance	-.244*	-.457 - -.009
Proportion familiar food consumed	-.379*	-.567 - -.156
Proportion unfamiliar food consumed	-.098	-.374 - .181
Meal duration	-.032	-.295 - .241

***p < 0.05, **p < 0.001**

3.5 Discussion

The present study aimed to validate maternal reported child food fussiness using the Food Fussiness subscale of the CEBQ against independent observations of children's eating behaviour. Supporting the hypothesis, the results indicate that children whose mothers reported greater levels of food fussiness were observed to exhibit more mealtime behaviours associated with food rejection and fewer mealtime behaviours associated with food acceptance. In addition, as expected, children whose mothers reported greater levels of food fussiness consumed smaller proportions of familiar foods during the observed mealtime consistent with previous findings (e.g., Dovey et al., 2008).

Contrary to the hypothesis and to previous research citing the rejection of unfamiliar foods as a feature of food fussiness (e.g., Dovey et al., 2008; van der Horst, Eldridge, Deming, & Reidy, 2014) maternal reported food fussiness was not associated with the proportion of unfamiliar foods consumed by the child during the mealtime. This may be due to floor effects (See Fig. 3.2), with children not consuming enough unfamiliar foods for associations with fussy eating to be found.

Contrary to expectations and to previous research where parents of fussy eaters have described their children as slow eaters who usually have prolonged feeding times (e.g., Reau et al., 1996; Timimi et al., 1997), the present study found that maternal reported food fussiness was not associated with mealtime duration. The present finding is consistent with those of previous studies that have used observational approaches to investigate meal duration in fussy eaters (e.g., Jacobi et al., 2003; Fries et al., 2017). It should be noted that studies that have found lengthened mealtimes to be a behavioural indicator of food fussiness have relied on parent-report. It is possible that due to the struggles that parents of fussy eaters experience during mealtimes to encourage food consumption, such parents may perceive mealtimes as being longer which could explain associations between food fussiness and longer meal durations. A possible explanation for the lack of association between food fussiness and meal duration during observations may be that fussy children are reject most food items, consequently have short mealtime durations. In contrast, some less fussy children might have spent a longer time consuming the food, requiring longer mealtime durations. The significant positive association between food consumption and mealtime duration in the present study lends support to this argument. In the present study, as mothers were asked to sit with their child during mealtimes, it is also possible that mothers' expectations of whether their child was likely to consume a meal might have affected the mealtime duration. For instance, it was observed that some mothers expected their children to eat some of the food items and used verbal prompts and some pressure to encourage them to consume the meal, resulting in longer meal durations. On the hand, some mothers did not expect their children to consume certain food items, used no strategies to encourage consumption, and offered no resistance when the child refused the meal, thus ending the mealtime quickly.

Mealtime food rejection behaviours found to be associated with food fussiness in previous studies (e.g., Boquin, Smith-Simpson, Donovan, & Lee, 2014; Fries et al., 2017; Klesges et al., 1983) were also observed in the present study. Children were observed playing with food, verbally and physically refusing food, spitting food out, touching and licking food without consuming it and making negative comments about food. While previous studies have reported a low occurrence of smelling of food as a mealtime behaviour associated with food neophobia and food fussiness (Blissett et al., 2012; Johnson et al., 2007; Momin et al., 2018) the present study found that smelling food occurred quite frequently during the mealtime observation. Children were observed to display this behaviour on occasions that led to both food rejection and food acceptance. However, smelling followed by food rejection was observed to occur more frequently and was found to be significantly negatively related to food acceptance behaviours. It is possible that smelling food may have been used as an exploratory strategy by children who were suspicious of some unfamiliar foods. Fussy eaters aged 2-5 years have been observed to become suspicious and inspect food during mealtimes by touching and licking presented food (e.g., Boquin, Smith-Simpson, Donovan & Lee, 2014; Luchini et al., 2016). In the present study, children's decision to accept or reject food following smelling may have been dependent on how appealing or unappealing they found the smell, with appealing smells resulting in food acceptance and unappealing smells in food rejection. While this proposed pattern could not be confirmed in the present study, future replications could determine whether smelling followed by food acceptance or food rejection is related to different foods, particularly foods children find appealing and unappealing. Overall, when included with other food rejection behaviours, smelling followed by food rejection contributed to a significant positive correlation with maternal reported food fussiness. The association between maternal reported food fussiness and smelling followed by rejection as a stand-alone variable also approached significance. Given this and findings of significant associations with food acceptance and food rejection behaviours, as well as its frequent occurrence during the observed mealtime, more research exploring smelling of food as an important mealtime behaviour associated with food fussiness is warranted. An interesting finding was that maternal positive comments about the presented food was positively related to several food rejection behaviours namely; refusing food, playing with food, spitting food and touching food. Maternal negative comments about food were unrelated to any mealtime behaviour although only two occurrences of this behaviour were recorded in this study. The main strength of the present study is its use of a behavioural observation approach to explore children's mealtime behaviours in a naturalistic mealtime environment in addition to a parent report food fussiness questionnaire. This approach permitted quantitative and objective measurement of the mealtime behaviours associated with food fussiness and offered insight into how maternal reported food fussiness relates to actual child mealtime behaviour. Observing children in their home environment where they are comfortable aimed to minimise changes to behaviour that can arise in unfamiliar settings. Providing children with age-appropriate portion sizes representative of a typical meal is another strength of this study and an improvement from methods where children's recommended portion sizes have been exceeded (e.g., Jacobi et al., 2003). In addition, providing children with several food items together as a plausible meal is more naturalistic than presenting food items in isolation. The present study's method of including familiar and unfamiliar foods from several food groups i.e. bread, vegetables, fruits, dessert, soup was an opportunity to observe how children approach a range of familiar and unfamiliar foods providing ample opportunity of observing food fussiness in its entirety. This is an improvement from methods where familiar and unfamiliar foods have been limited to one food group (e.g., Fernandez et al., 2018). In addition, with the inclusion of appealing and unappealing foods, it was possible to observe whether children would be willing to try foods mothers have deemed as both unfamiliar and unappealing.

Some limitations should also be noted. First, the presence of the camera during the recorded mealtime was likely to have affected children's behaviours. Although several measures were taken to ensure the child became accustomed to the presence of the camera before the mealtime observation commenced, many children remained aware of its presence which may have altered their usual behaviours. For example, many children were curious and commented on the presence of the camera and this may have affected their behaviour. Future replication where video-recording is unobtrusive would address this limitation.

Second, observation of children's mealtime behaviours was limited to a single occasion meaning it cannot be determined if the observed behaviours were children's typical behaviour. For example, some mothers commented on their child's unusual response to some of the presented foods. Comments such "He/she usually likes avocados" were made by some mothers in response to their child's refusal to try avocado during the recorded meal. It has been suggested that observing a particular behaviour more than once is required for an accurate representation of that behaviour as measures extracted from a single mealtime observation may not be a reliable summary of children's typical eating behaviour (Young & Drewett, 2000), therefore future research observing children on several occasions will help improve reliability.

Third, on reflection, the provision of all food items together in a single meal at the same time is not representative of a typical mealtime as children are not usually given their main meal together with dessert; with several mothers commenting that they would not typically serve dessert with the main meal. The provision of familiar and unfamiliar items as well as unappealing and unappealing items together is likely to have influenced children's decision to try some food items. On subsequent examination of the video recordings, it was observed that many children's attention was initially drawn to the dessert as they found this most appealing. Such children then proceeded to consume the dessert first and were reluctant to try the less appealing food items. Therefore, the method of including dessert together with other food items made it unclear how children would have responded to these foods in the absence of the dessert. Replication of this study where food items are not presented together but one after the other would help provide a more accurate assessment of children's responses to familiar and unfamiliar food items.

Fourth, the present findings cannot be generalised as the sample consisted of predominantly White British and well-educated mothers from two-parent households and are unrepresentative of the wider UK population. Given that this study only focused on mothers, it is not known if fathers are equally accurate when reporting on their children's eating behaviour. Therefore, future studies investigating whether these findings can be replicated with other ethnic and socio-economic status groups as well as with fathers is recommended.

3.6 Conclusion

Overall, the present finding of a correspondence between independent observations of children's food rejection and acceptance behaviours with maternal reports of food fussiness suggests that mothers are able to provide accurate and reliable information regarding their children's eating behaviour. These findings are feasible as mothers are generally the main caregivers and tend to interact with children during mealtimes therefore have observational access to their eating behaviours (Carnell & Wardle, 2007). The findings lends support to previous research that found maternal reports of child eating to be a reliable reflection of independent observations (e.g., Carnell & Wardle, 2007; Fernandez et al., 2018). However, these studies were limited by artificial testing environments and providing children with food limited to one food group. The present study improved on previous methods by observing children in their homes and the inclusion of foods from several food groups. Importantly, these results validate the food fussiness subscale of the CEBQ as an accurate measure of child food fussiness that can be used confidently in fussy eating research.

Chapter 4: Do maternal controlling feeding practices moderate the relationship between food fussiness and higher emotionality in children?

4.1 Abstract

Findings from Study 1, chapter two revealed higher emotional child temperament to be the strongest predictor of food fussiness in children aged 2-4 years when considered alongside other child temperament dimensions measured by the EAS, maternal cognition and maternal psychopathologic symptoms of depression, anxiety and stress. . It is unclear however how this temperament style interacts with other risk factors. One factor that may exacerbate or reduce the risk conferred by children's emotionality is parent feeding practices during mealtimes. In particular, the use of controlling feeding practices aimed at increasing food consumption may particularly affect emotional children. The primary aim of this study was to further investigate the association between controlling feeding practices and food fussiness found in previous studies. In addition, this study aimed to investigate whether the association between child food fussiness and higher emotionality is moderated by maternal use of controlling feeding practices, namely verbal pressure, physical prompts, food rewards and non-food rewards. Sixty-seven mother-child dyads were video-recorded during a meal in their home, from this video-recording, the use of controlling feeding practices and other key behaviours were coded. Mothers then completed a questionnaire measuring child temperament. Moderated regression analyses revealed that maternal use of verbal pressure and physical prompts moderated the relationship between food fussiness and higher emotionality. The relationship between food fussiness and emotionality was not moderated by maternal use of food and non-food rewards. These results are consistent with the possibility that for children higher in emotionality, the use of pressure and physical prompts may have a negative influence on fussy eating.

4.2 Introduction

Previous research has consistently found an association between highly emotional child temperament and food fussiness (e.g., Hafstad et al., 2013; Haycraft et al., 2011; Powell, Farrow, & Meyer, 2011) and this is supported by our findings from Study 1. It is not yet clear whether there are other factors that exacerbate or diminish this association between emotionality and fussiness. This is important because it can provide insight into the nature of fussy children and their experiences and may yield information that can be used to design interventions for children at risk of fussy eating due to their temperament.

It has been proposed that parents' use of controlling feeding practices might affect emotional children's risk for fussy eating (e.g., Hafstad et al., 2013; Haycraft et al., 2011). When faced with concerns about the consequences that food fussiness may have on their children's health and development, taking control over children's feeding is a strategy widely used by many parents. As previously highlighted in Chapter one (pp. 58-64), controlling feeding practices have positive and negative influences on food fussiness. Controlling feeding practices such as the use of verbal pressure, physical prompts and use of food rewards have been found to be associated with food fussiness in cross-sectional (Fisher & Birch, 1999; Webber, Hill, Cooke, Carnell, & Wardle, 2010) and prospective studies (Birch, Marlin, & Rotter, 1984; Galloway et al., 2005). It has been suggested that the use of these feeding practices may exacerbate food fussiness by promoting dislikes for foods that parents want children to eat (Galloway et al., 2005; Newman & Taylor, 1992; Newman & Layton, 1984). The use of non-food rewards, however, have been found to be an adaptive feeding practice resulting in food acceptance (e.g., Hendy, Williams, & Camise, 2005; Wardle, Herrera, Cooke, & Gibson, 2003). This may be attributed to the positive messages about the child's competence and achievement brought about by winning or earning non-food rewards such as stickers may convey to fussy eaters (Cameron et al., 2001).

The interplay between temperament and feeding practices is particularly important because research suggests that child temperament might influence feeding practices. For example, Tan and Holub (2011) found that parents who perceived their children as having low inhibitory control were found to use more restrictive feeding practices. Similarly mothers of infants scoring higher on difficult temperament reported using more food rewards (McMeekin, Jansen, Mallan, Nicholson et al., 2013). Finally a positive association has been found between indulgent feeding style and low negative affectivity (Hughes, Shewchuk, Baskin, Nicklas, & Qu, 2008). More recently, in a longitudinal study, Kidwell, Kozikowski, Roth, Lundahl and Nelson (2018) found that parents' perception of higher emotional temperament predicted the use of more instrumental and emotional feeding practices. These risk factors for fussy eating may interact such that controlling feeding practices exacerbate the relationship between emotionality and fussy eating.

The majority of previous studies that have investigated the relationship between parent feeding practices and food fussiness have assessed feeding practices through parent-report. As previously discussed in chapter one (p. 4), maternal reports of feeding interactions are relatively accurate (e.g., Whelan & Cooper, 2000; Cooper et al., 2004) as parents have the opportunity to observe their children's eating behaviours and are well informed, however there is evidence that parents under-report their use of certain practices (e.g., Melby et al., 1998). This study will therefore use an observational approach to more objectively assess mothers' use of feeding practices.

The present study had two aims: first to build on previous research that have reported associations between controlling feeding practices and food fussiness (e.g., Galloway et al., 2005; Webber, Cooke, Hill, & Wardle, 2010) by further investigating associations between controlling feeding practices and food fussiness, second to investigate whether the association between children's food fussiness and higher emotionality is moderated by maternal use of controlling feeding practices, namely verbal pressure, physical prompts, food rewards and non-food rewards. The following hypotheses were tested:

1. Maternal use of verbal pressure, physical prompts and food rewards will be positively associated with food fussiness.

2. Given that non-food rewards have been found to be positively associated with food acceptance and increase children’s fruit and vegetable intake, it was predicted that maternal use of non-food rewards will be negatively associated with food fussiness.
3. The association between emotionality and fussy eating will be stronger when more controlling feeding practices of verbal pressure, physical prompts and food rewards are used than when fewer of these practices are used.

4.3 Method

4.3.1 Design

This study was approved by the University of Reading’s Research Ethics Committee (UREC 15/43/KH).

4.3.2 Participants

This study made use of the participants in study 2 (See Chapter three, pp. 122 & pp. 125-126 for details on participant characteristics and participant recruitment). According to G*Power 3 (Faul et al., 2007), the final sample of 67 participants was sufficient to meet Cohen's (1992) power recommendation and yield statistical β power of 0.87 (based on α= 0.05) and to detect medium moderation effects (r = 0.15) when performing a regression analysis with up to 2 predictors and one interaction term (see Appendix Z).

4.3.3 Measures

4.3.3.1 CEBQ - FF Subscale (Wardle et al., 2001) - Appendix E

This study made use of the food fussiness subscale of the CEBQ to assess child food fussiness, which is described in detail in chapter two (pp. 96-97). As demonstrated in Study 2, chapter three, maternal responses on the food fussiness subscale was found to closely correspond to independent observations of children’s fussy eating. In the present study, Cronbach’s alpha for food fussiness was 0.94.

4.3.3.2 Emotionality Activity Sociability Scale (EAS; Buss & Plomin, 1984) – Appendix A

The EAS was used to assess children's emotional temperament, which is described in detail in Chapter two (p. 91). The present study made use of the emotionality subscale which comprised 5 questions e.g. my child cries easily. Cronbach's alpha for emotionality was 0.74 in the present sample.

4.3.3.3 The Family Mealtime Coding System (FMCS; Haycraft & Blissett, 2008) - Appendix S

The FMCS was used to assess the controlling feeding practices that mothers used during the mealtime observation. The FMCS is an observational measure based on the Child Feeding Practices subscales (CFQ; Birch et al., 2001) of pressure to eat and restriction. The FMCS comprises four subscales: pressure to eat, restriction of consumption, use of physical prompts and use of incentives/rewards. This study made use of three subscales of the FMCS: pressure to eat, use of physical prompts and use of rewards/incentives. In the present study, use of rewards/incentives was divided into use of food rewards and non-food rewards. Restriction is described in the FMCS as limiting the child's consumption of particular foods e.g. "you can't have any cake" or by restricting the amount of food the child is allowed to consume, e.g. "you can't have any more biscuits". Restriction as described by the FMCS refers to overt restriction demonstrated during mealtimes and not to the covert control of portion sizes or what the child consumes. Due to the design of this study, children were provided with a typical meal comprising of four food items at age appropriate portion sizes, overtly restricting the type or amount of food the child consumed during the mealtime, therefore restriction was not expected to be observed and was not measured in this study. Mothers could covertly control the order in which food items were presented to their children, however, for example choosing to offer dessert after the child had tried the other food items. The FMCS assesses the frequency of the feeding practices used by parents during mealtimes which are described briefly below:

4.3.3.3.1 Use of pressure

These are verbal encouragements from the parent to the child to persuade him/her to consume more food and includes vocalisations such as “try some more of the soup” or “have some more broccoli”.

4.3.3.3.2 Use of Physical Prompts

These are the parent’s use of physical movements to encourage the child to consume more food including strategies such as pushing a plate of food towards the child, placing the food on a fork/spoon ready for the child to pick up and eat or feeding the child.

4.3.3.3.3 Use of incentives/rewards

These are the parent’s use of verbal incentives or bribes to encourage and increase the child’s food consumption. These can either be food or non-food rewards/incentives. For example, “if you eat your peas, you can have your favourite pudding” or “mummy will let you play for an hour longer if you eat your peas”.

4.3.4 Procedure

The procedure for this study was the same as in Study 2 (See Chapter 3, pp 125 -128) involving the same participants. In addition to coding mealtime behaviours associated with food acceptance and food rejection, mothers use of controlling feeding practices; pressure, physical prompts, food rewards and non-food rewards were also coded.

4.3.4.1 Coding

Video recordings of mother-child dyads during the mealtime were coded offline by the researcher using the Observer XT9 Software (http://www.noldus.com/human-behaviourresearch/products/theobserver-xt-90). A coding scheme was defined which included a detailed description of the controlling feeding practice to be coded from the video recordings (See Appendix S). Each feeding practice was assigned a keyboard key and every time it was observed in the video recording, it was scored by pressing the corresponding keyboard key. A second coder was trained by the researcher to correctly identify behaviours from the videos based on the defined coding scheme. The second coder was trained until interrater reliability reached 90% (Cohens $k = 0.896$, $p < 0.01$). Raw data percentage agreements exceeding 75% have been proposed as an indication of an acceptable level of reliability (Stein et al., 2001). The second coder subsequently coded 25% of the videos with the percentage agreement between coders ranging from 79 - 92%, an indication that coding achieved a high reliability.

4.3.4.2 Data Analyses

Data was analysed using the Statistical Package for Social Sciences (SPSS), version 24. An initial check on the accuracy of data entry showed that the minimum and maximum values of all the study variables were within the expected range. Descriptive statistics for Food Fussiness, emotionality and controlling feeding practices are shown in Table 4.1. An examination of the normal probability plot and the histogram revealed the study variables to be skewed and non-normally distributed. This was further confirmed by significant Shapiro-Wilk's tests for normality on all variables making the data set unsuitable for parametric analysis. Log, reciprocal and square root transformations failed to improve the distribution of the variables therefore, bootstrapped analyses generating 95% bias- corrected bootstrapped confidence intervals of correlation coefficients (1000 samples, N =67) were used where possible. Confidence Intervals will be reported for significant bootstrapped correlations. The data was screened for assumptions made by regression analyses. Acceptable tolerance values in the collinearity statistics table (values < 0.1) indicated assumption of no multicollinearity.

Preliminary two-tailed bootstrapped Pearson's correlations were conducted to explore associations between child and parent sociodemographic factors with food fussiness, emotionality and feeding practices (See Table 4.2). Sociodemographic variables with more than two categories were recoded into dichotomous variables to meet the assumptions of correlation analysis as described in Study 1 (p. 101).

Bootstrapped partial correlations controlling for child age and marital status were performed to investigate associations between controlling feeding practices with food fussiness and emotionality.

Bootstrapped moderated regression analyses were used to investigate whether the relationship between food fussiness and emotionality is moderated by controlling feeding practices. Four separate bootstrapped hierarchical regression analyses were conducted to test the hypothesis that higher emotionality is associated with greater child food fussiness when more controlling feeding practices, namely pressure, physical prompts, food rewards and non-food rewards are used and with less child food fussiness when fewer controlling feeding practices are used. Before performing regression analyses, to avoid multicollinearity between the interaction variable with either the predictor or moderator, these variables were centred by subtracting the means from the individual scores and an interaction variable was created from the product of the centred variables.

In each analysis, the dependent variable was food fussiness, child age and marital status were entered in step 1 to control for their effects, the predictor (centred emotionality) and the moderator (centred controlling feeding practice) were entered in step 2 while an interaction variable derived from the product of the centred predictor and the centred moderator was entered in step 3.

Table 4-1 Descriptive statistics for child food fussiness, emotionality and controlling feeding practices (N = 67).

Measure	Mean (Std. Dev)	Range	Min/Max
Child Food Fussiness	3.19 (0.89)	1 - 5	1.67/5.00
Emotionality	3.26 (1.10)	1 - 5	1.00/5.00
Controlling Feeding Practices			
Use of Pressure	8.32 (3.42)		2.00/16.00
Use of Physical Prompts	5.81 (3.29)		0.00/12.00
Use of Non-food reward	1.91 (2.27)		0.00/7.00
Use of Food reward	4.06 (2.88)		0.00/12.00

Table 4-2 Two tailed bootstrapped Pearson's correlations between parent and child sociodemographic factors, child food fussiness, child emotionality and controlling feeding practices (N = 67).

	Food Fussiness	**Emotionality**	**Use of Pressure**	**Physical Prompts**	**Food rewards**	**Non-food rewards**
Child Age	.128	.151	**.338****	.171	.114	-.008
Child sex	.179	.048	-.052	.014	.092	.141
Maternal age	-.229	-.119	-.096	-.192	-.204	.138
Marital status	-.186	-.034	-.197	-.136	**-.300***	-.057
Maternal ethnicity	-.203	-.117	-.108	-.110	-.016	.014
Maternal education	.040	.093	.005	.063	-.029	.083

p < 0.05; ** p < 0.001

4.4 Results

4.4.1 Preliminary analyses

Descriptive statistics for the study variables are shown in Table 4.1 above. Mean scores on the CEBQ FF subscale for children in this sample are similar to the mean scores obtained from children in Study 1 and with a previous Dutch study that has used this measure with a similar age group (e.g., Debarse et al., 2016). Mean scores for emotional temperament measured using the EAS for children in this sample are slightly higher than the mean scores obtained from Study 1 and a previous study (e.g., Haycraft & Blissett, 2012) but are comparable with mean scores for emotionality obtained by previous studies with a similar age -group (e.g., Hafstad et al., 2013; Pliner & Loewen, 1997). Mean scores on the use of verbal and physical pressure observed from mothers in this sample using the FMCS are similar to the mean scores obtained from previous UK studies who used this measure with mothers of young children with a similar age group (e.g., Haycraft, Farrow & Blissett, 2013). The FMCS measures maternal use of incentives which comprises both food and non-food rewards while this was split into use of food rewards and use of non-food rewards. The combined mean of this feeding practice however is considerable higher for mothers in this sample compared to the mean score for use of incentives in previous studies (e.g., Haycraft & Blissett, 2008; Haycraft et al., 2013).

There was a significant positive correlation between child age and use of pressure (r =.338, 95% CI 0.133 – 0.546, p = .005). Mothers used more pressure with older children. There was a significant negative correlation between marital status and use of food rewards (r =-.300, 95% CI -0.569 – 0.025, p =.014). Mothers who were married or living with their partners used fewer food rewards than single mothers. Child age and marital status were therefore controlled for in all analyses.

Food fussiness was significantly correlated with emotionality, r = .725, p < .001, supporting previous findings (Study 1, chapter two). All controlling feeding practices with the exception of non-food rewards were significantly correlated with food fussiness and emotionality (see Table 4.3 below).

Table 4-3 Two tailed bootstrapped partial correlations between child food fussiness, child emotionality and controlling feeding practices (N = 67).

	Food Fussiness (95% CI)	Emotionality (95% CI)
Emotionality	.725** (.563 - .812)	
Use of Pressure	.624** (.443 - .774)	.411*(.157 -.605)
Physical Prompts	.590** (.401- .730)	.751** (.629 -.842)
Food rewards	.601** (.411 - .747)	.495** (.276 - .674)
Non-Food rewards	.147	.159

p < 0.05, ** p < 0.001

4.4.1.1 Use of pressure

Table 4.4 shows the results of the moderated regression analysis with food fussiness as the dependent variable and use of pressure and emotionality as the predictors. There were significant main effects of use of pressure and emotionality as well as a significant interaction term (emotionality * use of pressure), F (5, 66) = 18.669, p = .024 (Table 4.5). The significant interaction indicates that use of pressure significantly moderated the relationship between emotionality and food fussiness. The Process macro (Hayes, 2013) was used to investigate the interaction by testing the conditional effects of emotionality at three levels of the use of pressure: one standard deviation below the mean (fewer uses of pressure), at the mean (average uses of pressure) and one standard deviation above the mean (greater uses of pressure) (Table 4.6). The relationship between food fussiness and emotionality was significant when mothers used average or greater pressure during mealtimes. When maternal use of pressure during mealtimes was low, the relationship between food fussiness and emotionality was not significant. Examination of the interaction plot (Fig. 4.1) revealed that the strength of the relationship between food fussiness and emotionality increased when mothers used more pressure during mealtimes.

Table 4-4 Summary of Moderated Regression Analysis investigating whether the relationship between food fussiness and emotionality is moderated by maternal use of pressure (N = 67).

Step	R	R^2	ΔR^2
1. Child Age	.316	.100	.100*
Marital Status			
2. Emotionality	.755	.570	.471**
Pressure			
3. Emotionality * Pressure	.778	.605	.035*

***p <0.05; **p<0.001*, ΔR^2= R square change**

Table 4-5 Significant predictors of food fussiness using moderated regression analyses

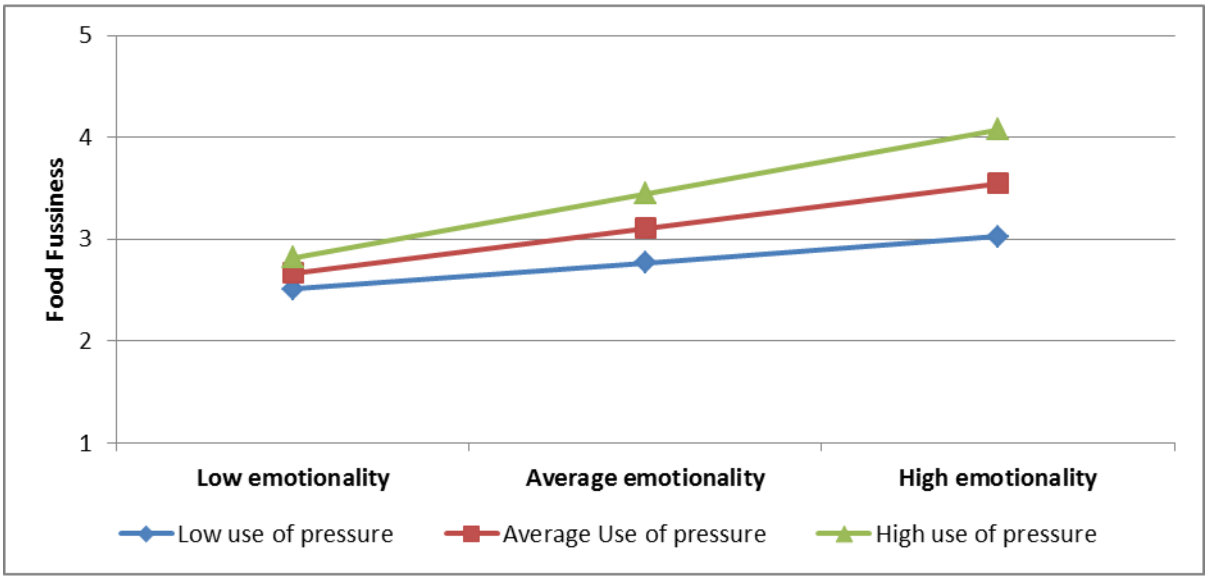
Step 3 (Final model)	B	SEB	β	95% CI
Emotionality	.311	.072	.386**	.160 -.476
Use of pressure	.124	.025	.475**	.073 -.180
Emotionality * Pressure	.048	.021	.190*	.002 -.096

p <0.05; ** p<0.001

Table 4-6 Conditional effects of emotionality on food fussiness moderated by maternal use of pressure.

Use of Pressure	B	SEB	t	p
1 SD below mean	0.14	0.98	1.42	.160
Mean	0.31	0.71	4.33	.000
1 SD above mean	0.48	0.99	4.79	<.001

Figure 4-1 Maternal use of pressure moderates the relationship between food fussiness and emotionality



4.4.1.2 Physical Prompts

The moderated regression analysis was repeated with physical prompts instead of use of pressure (see Table 4.7). There was a significant main effect of use of physical prompts and the emotionality * physical prompts interaction significantly predicted food fussiness F (5, 66) = 18.817, p = .036 (see Table 4.8). Using Process macro (Hayes, 2013), the emotionality- physical prompts interaction was probed by testing the conditional effects of emotionality at three levels of maternal use of physical prompts: one standard deviation below the mean (fewer uses of physical prompts), at the mean (average use of physical prompts) and one standard deviation above the mean (greater use of physical prompts) (Table 4.9). There was a significant relationship between food fussiness and emotionality when mothers used average or a higher number of physical prompts during mealtimes. When mothers used fewer physical prompts during mealtimes, the relationship between food fussiness and emotionality was not significant. Examination of the interaction plot (Fig. 4.2) revealed that the strength of the relationship between food fussiness and emotionality increased when mothers used more physical prompts during mealtimes.

Table 4-7 Summary of Moderated Regression Analysis investigating whether the relationship between food fussiness and emotionality is moderated by maternal use of physical prompts (N = 67).

Step	R	R^2	ΔR^2
1. Child Age **Marital status**	.316	.100	.100*
2. Emotionality **Physical Prompts**	.760	.577	.478**
3. Emotionality * Physical Prompts	.779	.607	.030*

p <0.05; **p<0.001, ΔR2= R square change

Table 4-8 Significant predictors of food fussiness using moderated regression analyses.

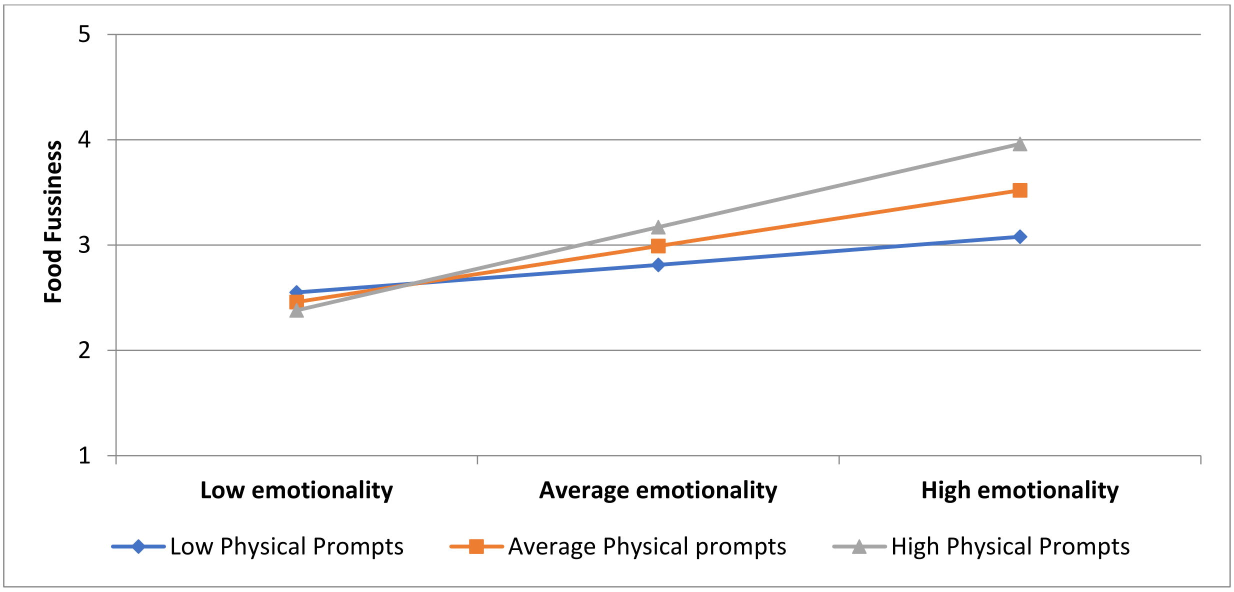
Step 3 (Final model)	B	SEB	β	95% CI
Physical prompts	.158	.034	.587**	.096 -.224
Emotionality * Physical Prompts	.061	.028	.201*	.015 -.030

p <0.05; **p<0.001

Table 4-9 Conditional effects of emotionality on food fussiness moderated by maternal use of physical prompts.

Physical Prompts	B	SEB	t	p
1 SD below mean	-.075	0.11	-.68	.499
Mean	0.16	0.10	1.59	.012
1 SD above mean	0.40	0.15	2.66	.009

Figure 4-2 Maternal use of physical prompts moderates the relationship between food fussiness and emotionality.



4.4.1.3 Use of food rewards

Moderated regression analysis was further repeated with food rewards (Table 4.10). There was a significant main effect of emotionality and food rewards. However, the emotionality * food rewards interaction did not significantly predict food fussiness

F (5, 66) = 13.646, p = .652, therefore the relationship between food fussiness and emotionality is not moderated by maternal use of food rewards during mealtimes (Table 4.11).

Table 4-10 Summary of Moderated Regression Analysis investigating whether the relationship between food fussiness and emotionality is moderated by maternal use of food rewards (N = 67).

Step	R	R^2	ΔR^2
1. Child Age **Marital Status**	.316	.100	.100*
2. Emotionality **Food rewards**	.726	.526	.427**
3. Emotionality * Food rewards	.727	.528	.002

p <0.05; ** p <0.001

Table 4-11 Significant predictors of food fussiness using moderated regression analyses.

Step 3 (Final model)	B	SEB	β	95% CI
Emotionality	.302	.083	.376*	.103 -.486
Food rewards	.124	.033	.403**	.067 - .212

p < 0.05; ** p< 0.001

4.4.1.4 Use of Non-food rewards

Finally, moderated regression analysis was repeated with non-food rewards (Table 4.12). There was a main effect of emotionality only and the emotionality * non-food rewards interaction did not significantly predict food fussiness F (5, 66) = 8.986 p = .333 (Table 4.13). Therefore, the relationship between food fussiness and emotionality is not moderated by maternal use of non-food rewards during mealtimes.

Table 4-12 Summary of Moderated Regression Analysis investigating whether the relationship between food fussiness and emotionality is moderated by maternal use of non-food rewards (N = 67).

Step	R	R^2	ΔR^2
1. Child Age	.316	.100	.100*
Marital Status			
2. Emotionality	.644	.415	.316**
Non-Food rewards			
3. Emotionality * non-Food rewards	.651	.424	.009

p < 0.05; ** p< 0.001

Table 4-13 Significant predictors of food fussiness using moderated regression analyses.

Step 3 (Final model)	B	SEB	β	95% CI
Emotionality	.444	.039	.552**	.280 - .646

p < 0.05; ** p< 0.001

4.5 Discussion

The aim of this study was to further explore associations between controlling feeding practices and food fussiness and to investigate whether the relationship between children's food fussiness and higher emotional temperament is moderated by maternal use of controlling feeding practices namely; pressure, physical prompts, food rewards and non-food rewards. As predicted and extending previous research (e.g., Birch, Marlin, & Rotter, 1984; Galloway et al., 2005; Jansen et al., 2017) maternal use of greater levels of pressure, physical prompts and food rewards were associated with greater child food fussiness. It is plausible that the use of pressure and physical prompts to influence food consumption in fussy eaters is likely to lead to struggles and conflict between mothers and children during mealtimes resulting in increased maternal perception of food fussiness. As previously discussed in chapter one (p. 64), the use of food rewards with fussy eaters often leads to a preference for the foods used as the reward and a decrease in liking for the rewarded foods. This makes sense as often food rewards are usually palatable foods such as snacks and confectionary which has been reported as fussy eaters' preferred foods (highlighted in Chapter one (p. 20). This has been attributed to over justification effects (e.g., Newman & Taylor, 1992; Newman & Layton, 1984) as discussed in Chapter one (p. 64) which suggests that if parents have to "bribe" fussy eaters to consume a disliked food, then it potentially reinforces their perception that the rewarded food is less palatable and does not taste nice compared to the food being used as a reward, resulting in decreased liking for the rewarded food. In addition, supporting the hypothesis and consistent with previous research (e.g., Stark, Collins, Osnes, & Stokes, 1986; Vereecken, Keukelier, & Maes, 2004), maternal use of non-food rewards was not associated with greater child food fussiness. As previously discussed in Chapter one (pp. 63-64), non-food rewards may convey positive messages about the child's competence and achievement. Fussy eaters may view non-food rewards such as stickers as a prize to be won which could encourage food acceptance as they are likely to feel a sense of accomplishment after they have won a particular “prize” for consuming a novel or disliked food (Cameron et al., 2001).

Consistent with predictions made at the outset of this study, the results also indicate that independent observations of maternal use of verbal pressure and physical prompts moderated the relationship between child food fussiness and higher emotional temperament. The relationship between food fussiness and higher emotional temperament was significant when mothers used a greater number of verbal pressure and physical prompts but was not significant when mothers used fewer verbal pressure and physical prompts. Contrary to predictions, independent observations of maternal use of food rewards failed to moderate the relationship between food fussiness and higher emotional temperament. It is plausible that the use of verbal pressure and physical prompts might be perceived by highly emotional children as negative and intrusive which may, in turn, trigger emotionally charged responses. Therefore, mothers who used more of these feeding practices were perhaps likely to have experienced more struggles from their highly emotional child, resulting in an increased perception of their child’s food fussiness. By contrast, it could be that mothers who used fewer pressuring practices perhaps experienced fewer struggles with their higher emotional temperamental child and therefore had a decreased perception of their child’s food fussiness. Although the use of food rewards is negative for fussy eaters as it results in decreased preference for the foods they are rewarded to consume, higher emotional temperamental children may perceive food rewards as less intrusive and more positive than verbal pressure and physical prompts. Consequently, mothers’ use of this feeding practice is unlikely to elicit emotionally charged responses from children with higher emotional temperaments, regardless of the frequency of use, and therefore have no influence on maternal perception of food fussiness. This may explain why food rewards failed to moderate the relationship between food fussiness and higher emotionality.

An interesting finding of the present study is the significant relationship between food fussiness and emotionality when more maternal controlling feeding practices were used alongside the lack of a significant association when fewer controlling feeding practices were used. These findings indicate that the relationship between higher emotionality and food fussiness may be dependent on the use of controlling feeding practices. Thus, children with emotional temperaments may be vulnerable to becoming fussy eaters only if their mothers use excessive verbal and physical pressure during mealtimes. This result aligns with a temperament x environment interaction theory previously discussed in chapter one (p. 43) that postulates that temperament does not lead to behavioural problems by itself but in conjunction with environmental factors (Bates et al., 1998).

A possible explanation for this finding may lie in the reaction of children with higher emotional temperaments to challenging situations and parents' response to this reaction (Fox, 1989; Little & Carter, 2005). Children with higher emotional temperaments are easily distressed and react intensely to situations that arouse anger and challenge them. Reactions are typically characterised by intense crying, hiding, temper tantrums and shrinking back (Buss & Plomin, 1984). Mealtimes can be a challenging time in early childhood as this is the period where children are expected to transition to adult food and are likely faced with new food experiences that elicit different reactions that vary from child to child (Mayeaux et al., 2010). Persuading children with higher emotional temperament to try new foods or foods which they deem as less palatable may be met with intense reactions from such children. If these reactions are interpreted as inappropriate or rebellious by mothers, it could result in mothers using controlling feeding practices to encourage food consumption which could, in turn, result in struggles between mother and child during mealtimes culminating in increased maternal perception of food fussiness. It is therefore plausible that negative mother-child interactions characterised by child negative affectivity and excessive maternal control result in power struggles and increased food fussiness. This is supported by contrasting findings showing that positive mother-child interactions result in "smooth-flowing" mealtimes characterised by fewer power struggles and healthier dietary self-regulation (Demir et al., 2012). As previously discussed, emotional temperament has been found to evoke parents use of instrumental and emotional feeding (Kidwell et al., 2018). Given this, it is also possible that maternal use of pressure may be a likely response to emotional temperament. It is also reasonable to assume that children with higher emotionality who are equally fussy may elicit more use of pressure from mothers during feeding. Such children are likely to be extremely distressed and refuse foods during mealtime which mothers may also interpret as rebellious promoting the use of controlling feeding practices thereby exacerbating food fussiness. While these interpretations of the study findings are plausible, the conclusions are impeded by the cross-sectional design of this study. The model proposed, of emotional temperament causing mothers to use controlling feeding practices which, in turn, leads to greater food fussiness is consistent with the findings, but an alternative is also possible; that food fussiness causes mothers to use more controlling feeding practices. Future research using longitudinal designs could clarify the temporal precedence of child food fussiness and maternal feeding practices. Caution should be taken in generalising the findings of this study as White British and highly educated mothers from two-parent households were over-represented in our sample. Feeding practices used by mothers to encourage food consumption in children during mealtimes has been found to vary by ethnicity and socio-economic status. For example, while middle income White American mothers report using sweets and salty snacks as food rewards, Hispanic-American mothers report using fruit as a treat while African American mothers report not offering snacks or special treats as rewards (e.g., Sherry et al., 2004). Lower economic status has been found to be associated with increased parental use of pressure (e.g., Cardel et al., 2012; Wehrly, Bonilla, Perez, & Liew, 2014) and more educated mothers have been found to use more restrictive feeding practices in comparison to less educated mothers (e.g., Vereecken et al., 2004). Therefore, future replications that include greater numbers of mothers from other ethnic and socio-economic groups would help establish if these findings can be generalised across UK populations. It should also be noted that findings are limited to mothers as fathers were not included in this study. Although mothers and fathers have been found not to differ in their use of controlling feeding practices (e.g., Haycraft & Blissett, 2008), it is not known how children higher on emotionality are affected by fathers use of controlling feeding practices therefore future replications with fathers is recommended. This study is limited by not measuring children's BMI as this information may have revealed differences in mothers use of controlling feeding practices. Research suggests that parental report on their use of controlling feeding practices is dependent on the child's weight (e.g., Brann & Skinner, 2005; Johannsen, Johannsen & Specker,2006). In these studies, parents reported using less pressuring and more restrictive feeding practices with children with higher BMI's due to concerns about their weight in comparison to children with average BMI. Given this, it is reasonable to assume that mothers in this study may have varied their use of controlling feeding practices depending on their child's weight. Mothers may have used more verbal pressure, physical prompts, use of food and non-food rewards to encourage food consumption in children with lower BMI in comparison to children with higher BMI. Another limitation is that information regarding whether mothers had other children in addition to the child participant in this study was not obtained. To reduce the variability that may occur at home where children might engage with their siblings on other non-food related activities or mothers might be distracted by attending to other children in the family, it was decided to observe the child and mother without the influence of other family members. Observations of mealtime interactions between mothers and child as well as other siblings, however, would have highlighted any differences between mothers' use of controlling feeding practices in response to child characteristics. For example, as previously discussed on pp. 60-61 and p.62, Farrow et al. (2009) found parents used more pressure and restriction when feeding children perceived as fussier in comparison to a less fussy sibling. It is recommended that future replications should consider the role of siblings in observations of parent use of controlling feeding practices. While independent observation of mothers' feeding practices in their own homes was a key strength of this study as it allowed for a first-hand experience of real time overt behaviour that was not reliant on self-report; where mothers may be unwilling to report the use of certain practices and/or may have limited awareness of their own behaviour (Bergmeier, Skouteris, & Hetherington, 2015). On reflection, self-report accounts of mothers use of controlling feeding practices should also have been obtained as this would have provided an opportunity to ascertain whether mothers in this study can accurately report on their use of feeding practices. Observing mothers may have introduced some social desirability biases. The presence of the camera, and the fact that mothers knew that mealtimes were being recorded, may have influenced mothers' use of some feeding practices and may not be a true reflection of typical behaviour. Future research involving repeated observations of mothers feeding practices on several occasions over time could help reduce behaviour that is not typical and improve ecological validity.

The fact that children were given unfamiliar and familiar foods as well as foods considered as appealing and unappealing during the mealtime may have influenced mothers use of controlling feeding practices. Mothers may have expected their children to consume foods that were familiar and deemed as appealing and may have used more controlling feeding practices to encourage food consumption. On the hand, it is plausible that mothers may have used fewer controlling feeding practices to encourage consumption in foods that were unfamiliar and deemed unappealing to their child. Future replications should determine the effects of familiar, unfamiliar, appealing and unappealing foods on mothers use of controlling feeding practices.

An important point to consider in maternal use of controlling feeding practices is mothers' psychopathology. As previously emphasized in chapter one (p. 50), maternal symptoms of depression, anxiety and stress have been found to affect how mothers interact with their children resulting in the use of less sensitive and more controlling feeding strategies during mealtimes to deal with their children's fussy eating (e.g., Gordon, 2003; Hurley, Black, Papas, & Caulfield, 2008; Mitchell et al., 2009). However maternal psychopathology was not measured in the present study because the focus was on whether maternal use of controlling feeding practices moderated the relationship between child food fussiness and emotionality. It is possible that maternal psychopathology may have affected mother's use of controlling feeding practices with mothers with higher levels of depression, anxiety and stress using more of such feeding practices with children with higher emotional temperament during mealtimes. Future replications should therefore measure and control for maternal psychopathology when investigating the moderating effects of maternal use of controlling feeding practices on the relationship between child food fussiness and emotionality.

There is also evidence that higher emotionality is associated with aspects of sensory hyperreactivity. Individuals high in sensory processing sensitivity; a trait characterised by high sensitivity to environmental stimuli have been found to have higher emotional responses overall (Aron & Aron, 1997; Aron, Aron & Davies, 2005). Therefore, children with higher emotionality may have a heightened response to the sensory properties of food and may be unwilling to try many foods. This will be investigated further in the next study of this thesis.

4.6 Conclusion

Overall, the present study highlights that while higher emotional temperament may potentially be a risk factor for the development of children's food fussiness, the feeding practices that mothers use during mealtimes may ultimately determine if such children become fussy eaters. Given that child temperament is an inherent characteristic which is not amenable to change whereas parents feeding practices are modifiable, this finding may be used to inform future interventions aimed at increasing food consumption and dietary variety in fussy eaters. Future interventions may be better targeted at educating parents of fussy eaters on the detrimental effects of the use of controlling feeding practices with fussy eaters and to train parents to use more adaptive feeding practices such as modelling, positive reinforcement and repeated exposure that have been shown to be associated with healthy eating behaviours. A few interventions based on these principles have previously been evaluated. For example, as previously discussed in chapter one (pp. 76-77), the "Fun not Fuss with Food" programme (Fraser et al., 2004) where parents were educated to use adaptive feeding practices such as modelling and positive reinforcement resulted in a significant reduction in food fussiness. Similarly the "fun with food" educational programme (Haywood & McCann, 2009) which instructed parents not to use pressuring feeding strategies resulted in an increase in the range of foods accepted by fussy eaters. However, as previously highlighted, the long-term benefits of these interventions on food fussiness is unknown, therefore future interventions designed to test the long-term effects of parental use of adaptive feeding practices on food fussiness is warranted. In summary, this study highlights the negative influence of the use of coercive feeding practices with children higher on emotionality, future interventions should be aimed at developing effective feeding strategies for children with higher emotional temperaments to prevent the development of food fussiness in such children.

Chapter 5: Does sensory hyperreactivity explain unique variance in predicting food fussiness over and above emotional temperament?

5.1 Abstract

Of the correlates of food fussiness examined in Study 1 (pp. 86-179), child emotional temperament had the strongest association. Previous research has provided evidence of a relationship between sensory hyperreactivity in children and food fussiness, but sensory hyperreactivity was not examined in Study 1. The aim of this study, therefore, was to further investigate associations between children's sensory processing and food fussiness, and to determine whether these associations remain after controlling for child temperament. This study also explored possible interactions between temperament and sensory hyperreactivity in predicting food fussiness. Data regarding children's sensory processing was obtained from 79 mother- child dyads via observation (children were presented with sensory stimuli) and maternal-report. Mothers also completed questionnaires measuring child temperament and food fussiness. Correlation analyses showed high sensory hyperreactivity in tactile, taste and olfactory sensory modalities were significantly positively associated with food fussiness. Hierarchical regression analyses revealed that tactile, taste and olfactory hyperreactivity explained a proportion of variance in food fussiness over and above emotionality. There was no significant interaction between emotionality and sensory hyperreactivity in predicting food fussiness across any measured sensory modalities.

5.2 Introduction

As reviewed in Chapter one (pp. 45-46), the relationship between emotional child temperament and food fussiness has been well documented in cross sectional and prospective studies (e.g., Hafstad et al., 2013; Haycraft et al., 2011; Pliner & Loewen, 1997). These studies found higher emotional temperaments are related to increased food fussiness in early childhood. This finding was replicated in Study 1 (Chapter two) where emotional temperament was found to be the strongest predictor of food fussiness in children aged 2-4 years when considered alongside other child temperament dimensions measured by the EAS, maternal cognition and maternal psychopathologic symptoms of depression, anxiety and stress. However, extant studies fail to elucidate how emotional temperament is related to, and affected by, other risk factors for food fussiness. Study 3 (Chapter four) began to address this issue by examining whether maternal controlling feeding practices moderated the relationship between food fussiness and emotionality. Study 4, described here, takes a similar approach but considers an alternative factor that might be related to food fussiness in children, namely their sensory processing.

Previous literature discussed in Chapter one (pp. 69-74), reviewed research that had begun to explore the relationship between sensory hyperreactivity and food fussiness. Cross -sectional studies have found tactile hyperreactivity is associated with food neophobia and food fussiness (e.g., Nederkoorn, Jansen, & Havermans, 2015; Smith, Roux, Naidoo, & Venter, 2005; Werthmann et al., 2015). Several studies have also explored associations between food fussiness and sensory hyperreactivity in other sensory domains. As previously discussed in Chapter one (pp. 72-74), a positive association between food fussiness and: tactile; olfactory; and taste hyperreactivity, but not visual or auditory hyperreactivity, has been reported in cross-sectional studies (e.g., Boquin, Moskowitz, Donovan, & Lee, 2014; Coulthard & Blissett, 2009; Farrow & Coulthard, 2012; Zucker et al., 2015). Higher sensory hyperreactivity at age four year has also been found to be a longitudinal predictor of food fussiness at age six years (Steinsbekk, Bonneville-Roussy, Fildes, Llewellyn, & Wichstrøm, 2017). Taken together, these findings suggest that sensory hyperreactivity, particularly in the taste, tactile and olfactory sensory domains is a risk factor for the development of fussiness.

While sensory hyperreactivity and food fussiness have been investigated in the context of anxiety as a risk factor for fussiness in children and adolescents (e.g., Farrow & Coulthard, 2012; Zickgraf & Elkins, 2018) to date, there is no published research investigating sensory hyperreactivity and food fussiness, in the context of child temperament, as a risk factor for food fussiness. Given the consistent associations found between emotionality and food fussiness, including the findings presented in Study 1 (pp. 108-111), the present study evaluates associations between emotionality, sensory hyperreactivity and food fussiness. Furthermore, as discussed in, Chapter one (pp. 72-74), a clear limitation of the majority of research investigating associations between food fussiness and sensory hyperreactivity is its reliance on parental report, which is subject to bias. This can be addressed by combining parent-report with a systematic observation of children's responses to the presentation of sensory stimuli.

The aim of the present study was to further investigate associations between sensory hyperreactivity in taste, tactile and olfactory sensory domains with food fussiness, and to evaluate whether these associations remain after controlling for the effects of emotionality. The potential for an interaction between emotionality and sensory hyperreactivity in predicting food fussiness was also explored. To address the limitation of previous research, data were obtained via both parent report and observation of sensory processing.

It was hypothesized that based on previous research, high sensory hyperreactivity in taste, tactile and olfactory sensory domains will be positively associated with food fussiness. Given the lack of previous research examining sensory hyperreactivity and emotionality together in the context of food fussiness, it was tentatively hypothesised that sensory hyperreactivity would be related to food fussiness even after controlling for emotionality. The interaction analysis was exploratory.

5.3 Method

This study was approved by the University of Reading's Research Ethics Committee (UREC 2017/047/TT) – See Appendix W and X for participant information sheet and consent forms.

5.3.1 Design

In this within-subject cross-sectional study, children's reactions to the presentation of sensory stimuli across five sensory modalities, namely; visual, tactile, olfactory, auditory and taste were observed. Mothers were also asked to complete a series of questionnaires relating to children's food fussiness, sensory processing and child temperament. Mothers were subsequently interviewed to obtain a measure of their perception of children's sensory responses to everyday stimuli.

5.3.2 Participants

Preschool-aged children (3-4 years) were recruited as part of a larger study called the 'Watch Them Grow' project (Dodd, Ryan, & Rayson, 2017), which focuses on preschool predictors of anxiety when children start school. Recruitment for the Watch Them Grow project took place via local Facebook groups, advertising through nurseries and paid magazine advertising. Interested families were asked to visit a website which contained all study information and register their interest to take part. They were then contacted by a member of the "Watch Them Grow" team to participate. Children who had special educational needs were not eligible for the Watch them Grow project because their transition to school was likely to be atypical. Special educational needs refer to children with learning difficulties or disabilities that make it harder for them to learn than most children the same age, consequently, they were excluded from this study. For the taste hyperreactivity test, mothers were asked if their children had a lactose, nut or gluten intolerance as children were offered food items that may have contained these ingredients. If mothers had indicated lactose or gluten intolerance in their child, then the child would have been excluded from the taste hyperreactivity test. This would have also resulted in the child's data excluded from the final analyses due to missing information on a variable of interest. None of the mothers in the present study indicated that their child had a lactose or gluten allergy. To participate in the "WTG" study, children had to be in their preschool year, meaning that they would start school in the September following their participation. All 180 families who had completed the baseline assessment for the Watch Them Grow project were invited to participate in the study described here (See Appendix Y for invitation email). Of the 180 families invited to participate in this study, 80 parent-child pairs agreed comprising 79 mother-child pairs and 1 father-child pair. As this thesis has so far focused on mothers, data from the father-child pair was excluded from analyses leaving a final sample of 79 mother-child pairs. According to the statistical power analysis program G*Power (Faul et al., 2007), 79 participants was sufficient to obtain β Power of 0.92 and a medium effect size of F = 0.15 for detecting an increase in R^2 when performing a regression analysis with 3 predictors, 2 independent predictors (emotionality and sensory hyperreactivity) and one interaction term (emotionality x sensory hyperreactivity) (see Appendix Z). Children who participated in this study were aged from 3 to 5 years (M = 4.23, SD = 0.58) with maternal age ranging from 24 to 44 years (M = 36.21, SD = 4.22) and were described by their mothers as predominantly White British (84.7%). Of all the mothers taking part, 73.4% had a university degree or higher university level education, 87.8% were either married, in civil partnerships or cohabiting and over half (52.5%) were either in full or part- time employment (See Table 5.1 below for participant characteristics).

Table 5-1 Study 4 Participant Characteristics (N = 79)

Sociodemographic variables	Number of participants	n (%)
Child Sex		
Male	34	43%
Female	45	57%
Child Ethnicity		
White British	67	84.7%
White European	5	6.3%
Asian or Asian British (Indian Origin)	1	1.3%

Asian or Asian British (Pakistani Origin)	1	1.3%
Asian British (Chinese Origin)	1	1.3%
Mixed Race	3	3.8%
Other	1	1.3%
Maternal Education Level		
Primary School	1	1.3%
GCSE	7	8.9%
A' Levels	5	6.3%
College Course Certificate	8	10.1%
Bachelor's Degree	42	53.1%
Master's Degree	7	8.9%
Postgraduate Degree	9	11.4%
Maternal Employment Status		
Employed Full Time	4	5%
Employed Part Time	38	47.5%
Full Time Homemaker	28	35%
Unemployed	10	12.5%
Marital Status		
Single	8	10.1%
Married	60	75.9%
Divorced	2	2.5%
Other	9	11.5%

5.3.3 Measures

Two measures used in Study 3 and already described in chapter 2 (pp. 96-97 and p. 91, respectively) were used again in this study: this study made use of the 6-item food fussiness subscale of the CEBQ (Wardle et al., 2001) and the EAS (Buss & Plomin, 1984).

The unique aspect of this study within the context of this thesis is the investigation of sensory hyperreactivity in relation to food fussiness. To measure sensory hyperreactivity we used the Sensory Assessment for Neurodevelopmental Disorders (SAND; Siper, Kolevzon, Wang, Buxbaum, & Tavassoli, 2017), the SP3D Parent Inventory (Schoen et al., 2008) and the Short Sensory Profile (Dunn, 1999).

5.3.3.1 Sensory Assessment for Neurodevelopmental Disorders (SAND; Siper, Kolevzon, Wang, Buxbaum, & Tavassoli, 2017) – Appendix T

The SAND was developed to obtain quantifiable information on sensory reactivity symptoms specific to Autism Spectrum Disorder (ASD) as defined by DSM-5 criteria. The SAND consists of an observation and corresponding caregiver interview designed to measure sensory reactivity in children. Administration of the SAND consists of unstructured play with the child to get him/her acquainted with the testing environment and the researcher. Unstructured play is then followed by the SAND observation. The observation involves direct presentation of sensory stimuli to the child with five stimuli presented within each sensory modality (visual, tactile, auditory, olfactory and taste). Children's behaviour responses are first dichotomised into absence or presence of behaviour, in other words, a score of 0 is given when the behaviour is not present and a score of 1 when a behaviour such as refusing to touch an object is present. If present, children's behavioural responses are further rated across sensory modalities into three DSM-V ASD symptom domains: sensory hyperreactivity, sensory hyperreactivity and seeking behaviours. Hyperreactivity refers to behavioural responses that are more extreme in comparison to typical responses. Hyporeactivity refers to behavioural responses that are less in comparison to typical responses. Seeking behaviours refers to behavioural responses that are unusual due to the frequency or intensity of response to a stimulus. For each domain, a severity score of 1 (mild) and 2 (moderate-severe) is coded within each modality.

The corresponding caregiver interview consists of 36 items and follows the same format. Caregivers are first asked to indicate whether their child shows signs of a given sensory behaviour or not. If the behaviour is present, caregivers are then asked to rate its severity (mild or moderate-severe) within each domain (e.g. Tactile hyperreactivity).

Total SAND scores are derived by combining responses on the observation and caregiver interview. The SAND provides an overall total score (observed + caregiver reported), scores by sensory modality (visual, Tactile, auditory, Olfactory and taste) and scores by DSM-5 ASD symptom domain scores (sensory hyperreactivity, sensory hyporeactivity and sensory seeking). Domain scores range from 0 to 30 with a total SAND score ranging from 0 to 150; higher scores indicate greater levels of sensory reactivity symptoms. The observation is always conducted prior to the caregiver interview to avoid any bias that may result from prior knowledge of the child's sensory preference gleaned from the interview.

The present study was focused on the effects of high sensory hyperreactivity on the relationship between food fussiness and emotionality therefore only SAND hyperreactivity scores were used. Hyperreactivity scores were calculated for each sensory modality with scores ranging from 0 to 10 for observed + reported hyperreactivity. Hyperreactivity scores ranged from 0 to 5 for SAND observed and SAND reported respectively; higher scores indicate greater sensory hyperreactivity. Sensory hyperreactivity was indicated by stronger reactions to the presented stimuli during the observation and parent's indication that a behaviour is present in the corresponding interview (See Table 5.2 below).

The SAND has been found to have very high internal consistency with an alpha value of 0.90 and good test-rest reliability with intraclass correlation coefficient (ICC) values of 0.97 for total scores, 0.82 for observed scores and 0.97 for reported scores (Siper et al., 2017) and can be used with both typical and non-typically developing children. The SAND has also been found to have strong convergent validity with the Short Sensory Profile (SSP), scores on the SAND significantly correlated with SSP scores, although this was only observed in children with ASD and not in typically developed children (Siper et al.,2017). The SAND has a cut-off score of greater than or equal to 13 for total SAND scores (observed + reported) to differentiate between children with and without clinically significant sensory hyperreactivity (Siper et al., 2017). Administration of the SAND consists of unstructured play with the child to get him/her acquainted with the testing environment and the researcher. Unstructured play is then followed by the presentation of sensory stimuli per sensory modality i.e. tactile, taste, olfactory, visual and auditory. Children's behavioural responses are rated by the researcher for observed hyperreactivity, hyporreactivity and seeking behaviours across sensory domains. The SAND was chosen as a measure of sensory hyperreactivity as it allows for independent observations of children's responses to sensory stimuli and for a comparison between observed and caregiver-reported sensory reactivity scores. Previous research investigating associations between food fussiness and sensory hyperreactivity has relied mainly on the use of parent-report which has the disadvantage of being subject to bias, while observational approaches provide opportunities for the independent evaluation of children's reaction to sensory stimuli. Interviews have an advantage over questionnaire assessments as they provide opportunities for the clarification of confusing questions.

Table 5-2 Examples of observed and reported sensory hyperreactivity items from the SAND

Sensory Modality	Observed Hyperreactivity	Interview
Visual	Covers, squints or closes eyes in response to bright or flickering visual stimuli	Does your child ever show an aversive reaction to bright or flickering visual stimuli? For example, some children squint, cover, or close their eyes in response to bright or flickering lights?
Tactile	Rubs skin or is bothered by different textures	Does your child ever appear bothered by different textures, (i.e., sirens), refuses to wear certain clothes?
Olfactory	Bothered by smells, holds nose	Does your child turn away from ordinary smells?
Auditory	Startles in response to sounds, covers ears	Does your child often startle in response to ordinary sounds (e.g. hair dryer, vacuum cleaner, and phone ringing)?
Taste	Bothered by different food properties, removes food from mouth	Does your child gag in response to ordinary food?

5.3.3.2 Short Sensory Profile (SSP; Dunn, 1999) - Appendix U

The Short Sensory Profile (SSP) is a 38 item parent-report questionnaire used to measure children's sensory responses to sensory stimuli (Dunn, 1999). The SSP consists of seven subscales: Tactile Hyperreactivity, Taste/Smell Hyperreactivity, Movement Hyperreactivity, Under responsive/Seeks Sensation, Auditory Filtering, Low energy/Weak and Visual/Auditory Hyperreactivity. The present study made use of three subscales namely; Tactile, Taste/Smell and Visual/Auditory hyperreactivity. Seven items of the SSP assess Tactile hyperreactivity (e.g., "Avoids going barefoot, especially in sand or grass"). Four items assess Taste/Smell Hyperreactivity (e.g. "Avoids certain tastes or food smells that are typically part of children's diets"). Five items assess Visual/Auditory Hyperreactivity (e.g., "Covers eyes or squints to protect eyes from light"). Parents indicate on a five-point Likert scale (1 = always to 5 = never) how well these statements describe their child's behaviours. Scores for each subscale are determined by computing the sum of the scores, with higher scores indicating typical levels of sensory processing. The SSP was chosen as it is the most widely used measure of sensory hyperreactivity that has been used in previous studies investigating sensory processing in early childhood. It has good internal and external validity (Dunn, 1999) and has been validated in clinical and non-clinical samples of children (Tomchek & Dunn, 2007).

5.3.3.3 Sensory Processing Three Dimensions Parent Inventory (SP3D; Schoen et al., 2008) - Appendix V

The Sensory Processing Three Dimensions scale (SP3D), previously known as the Sensory Processing Scale is a measure of sensory modulation, sensory discrimination disorder and sensory-based motor disorder. The SP3D consists of six subscales measuring sensory over-reactivity (SOR), sensory craving (SC), sensory under-reactivity (SUR), postural disorder (PD), dyspraxia (DYS) and sensory discrimination disorder (SDD) which reflects sensory reactivity across tactile, visual, olfactory, auditory, taste, vestibular and proprioception sensory domains. The subscales regarding Sensory Over-Reactivity (SOR), Sensory Craving (SC) and Sensory Under-Reactivity (SUR) were administered in this study. The SOR consists of 76 items and includes statements such as "these tactile sensations bother my child, e.g. glue". The SUR is made up of 30 items with statements such as "Typically my child does not notice hands or face that are messy/dirty" while the SC has 37 items and includes statements such as "My child enjoys watching flickering or blinking objects".

As the present study was interested in the effects of high sensory hyperreactivity on the relationship between food fussiness and emotionality, only SP3D sensory over-reactivity scores were used. A score of 0 was given if mothers ticked “no” to indicate the absence of a behaviour or a score of 1 if mothers ticked “yes” to indicate the presence of a behaviour, total sum scores were calculated with higher scores a reflection of greater sensory over-reactivity. The SOR subscale has been shown to have high internal consistency across all sensory domains, Cronbach’s $\alpha = 0.65 - 0.88$ (Schoen et al., 2008).

The SP3D was included alongside the SAND and SSP because of concerns about the items assessing taste hyperreactivity in the SAND and the SSP. On inspection it was judged that these items might be assessing fussy eating rather than sensory responses e.g. “my child spits out food” and “my child is a picky eater, especially regarding food textures”. The SP3D was chosen as the items measuring taste hyperreactivity tended to assess children’s’ reactions to the sensory properties of food e.g. “slimy foods bother my child” rather than food fussiness per se. Thus, if findings are consistent across measures, we can be confident that associations are not due to item overlap between sensory measures and food fussiness questionnaires.

5.4 Procedure

Children were tested individually at the University of Reading infant lab and were accompanied by their mother. Upon arrival, following greetings and introductions, the researchers encouraged the child to engage in unstructured play for several minutes with the aim of familiarising the child with the test environment. Prior to the SAND observation sensory sensitivity test, the child took part in a brief eye tracking task which was related to the broader Watch them Grow study. The eye-tracking task involved the child looking at different cartoon scenes on a computer screen and lasted for 10 minutes. This task was presented to the child as a game and although it was unrelated to the present study, it served to put the child at ease. When this was completed, mothers completed the EAS, SSP, SP3D and the Food Fussiness subscale on an Apple iPad while the child took part in the SAND observation sensory sensitivity test.

The SAND observation sensory sensitivity test was conducted following the standardised procedure in the manual (Siper et al., 2017). This involved the researcher presenting the child with five sensory toys for each sensory modality, e.g. visual: spiral disc, handheld sparkle wheel; 25 sensory stimuli in total (See Table 5.3 below). The SAND observation included a visual, tactile, olfactory, taste and auditory sensory sensitivity test. For example, the visual sensory sensitivity test involved instructing the child to watch a spinning disc, which produces a visual motion after-effect when spinning is terminated. An example of the tactile sensitivity test involved asking presenting the child to extricate a toy dinosaur embedded in mouldable goo. An example of the auditory sensitivity test involved inviting the child to press two buzzers which emitted a police siren and a fire engine sound respectively. For the taste sensitivity test, children were invited to taste five foods representing salty, sour, sweet, spicy and bitter. Finally, in the olfactory sensitivity test, children were invited to smell a variety of oils in vials and to indicate if they recognised the smell by pointing to a chart which had images of the items relating to the oil vials. It should be noted when scoring in the SAND, the interest was in children's reactions to the presentation of stimuli in these sensory domains rather than accuracy for direct measures. For example, in the olfactory domain, scoring of hyperreactivity was based on the child's reaction (e.g., withdrawal of their nose to a presented vial) rather than whether they accurately recognised the smell. Similarly, in the taste domain, scoring of hyperreactivity was based on the child's reaction (e.g., removing the food from his/mouth, screwing up their face) rather than correctly identifying sweet, salty, sour, etc. taste categories. The SAND observation was videotaped using a video recorder. The child's behavioural responses to the presentation of the sensory stimuli was rated by the researcher for observed sensory hyperreactivity, hyporeactivity and seeking behaviours through live observations Following completion of the SAND observation, the child was allowed to resume unstructured play while the researcher obtained interview data from the parent (SAND caregiver interview). Finally, children were thanked and received stickers and a small gift (blow bubbles) for their participation.

As previous research has reported associations between food fussiness and sensory hyperreactivity in tactile, olfactory and taste sensory modalities but failed to observe associations between auditory/visual sensory hyperreactivity and food fussiness (e.g., Farrow & Coulthard, 2012; Nederkoorn et al., 2015; Zucker et al., 2015), the present study focused on investigating associations for which there was evidence, namely between food fussiness and sensory hyperreactivity in tactile, taste and olfactory sensory modalities. Data for sensory hyperreactivity in visual and auditory domains were therefore excluded from the final analyses.

Table 5-3 List of stimuli used in SAND observation.

Sensory Modality	Sensory Stimuli
Visual	• Spiral disc • Handheld sparkle wheel • Flashing lights • Bubble wheel • Fluorescent tubes
Tactile	• Vibrating toy • Inside-out prickly ball • Mouldable goo • Toothette • Paint Brush
Auditory	• Musical toy • Buzzer • Brass cymbals • Whistle • CD with music
Olfactory	A variety of oils in vials • Lemon • Garlic • Rose petals • Cinnamon • Lavender
Taste	• Lemon sherbet (sour) • Strawberry yoghurt (sweet) • Salty pretzels (salty) • Tonic water (bitter) • Sweet chilli crackers (spicy)

5.4.1 Data Analysis

Data was analysed using Statistical Package for Social Sciences (SPSS), version 24. Minimum and maximum values of all the study variables were within the expected range confirming data entry accuracy. The dataset contained 43 missing individual item responses. Of the 79 participants, 28 participants had at least one missing data point on one or more of the SOR, EAS, CEBQ and the SSP scales. There was no discernible pattern to the missing data points and no participant was missing more than 10% of the items on any one scale. A non-significant Little's MCAR test, $p = 0.182$, indicated that data was missing at random therefore an Expectation Maximization (EM) technique (Dempster, Laird, & Rubin, 1977) was used to estimate and impute missing data values. EM forms a missing data correlation or covariance matrix by assuming the shape of a distribution for the missing data and iteratively inserts missing values based on the distribution (Tabachnick & Fidell, 2007).

An examination of normal probability plots and histograms revealed skewness and non-normality in the distribution of most of the study variables which was further confirmed by a significant Shapiro-Wilk's test. Eight cases with extreme z-scores (z-score > 3.29, $p < 0.05$) were identified as univariate outliers. Examination of the cases with extreme z scores showed that they were not as a result of data entry errors as scores were within scale ranges, although higher than the scores of majority of respondents. It was therefore decided to retain these cases as they were legitimate outliers, however they were Winsorized by replacing their scores with a score derived from the mean of the data plus three times the standard deviation (Field, 2013). The normality of the distributions was not improved by Winsorizing the outliers or by the use of log, reciprocal or square root transformations. It was therefore decided to use a bootstrapping procedure to generate 95% bias- corrected bootstrapped confidence intervals of the correlation coefficients (1000 samples, $N = 79$) in all analyses. Statistical significance was set at $p < 0.05$, confidence Intervals were reported for all bootstrapped correlations.

Two-tailed bootstrapped Pearson's correlations were performed to explore the relationship between SAND observation hyperreactivity and SAND interview hyperreactivity across tactile, olfactory and taste sensory modalities. There were no significant relationships between SAND observation and SAND interview hyperreactivity across these sensory modalities (See Table 5.4 below), therefore all analyses examined SAND observation and SAND interview hyperreactivity separately.

Table 5-4 Two tailed bootstrapped correlations between SAND observation and SAND Interview hyperreactivity across tactile, olfactory and taste sensory modalities (N = 79)

			Hyperreactivity SAND interview		
			Tactile	**Olfactory**	**Taste**
Hyperreactivity SAND	**Observation**	**Tactile**	.025		
		Olfactory		-.067	
		Taste			-.014

Table 5-5 Descriptive statistics for child food fussiness, emotionality, sensory hyperreactivity (SAND Observation, SAND Interview, SSP and SP3D questionnaires) (N= 79).

Measure	**Mean (SD)**	**Median**	**Range**	**Min/max**
Child Food Fussiness	2.89 (0.75)	3.00	1-5	1.33/5.00
Emotionality	2.53 (0.90)	2.40	1-5	1.00/4.80
SAND Observation Hyperreactivity				
Tactile	0.75 (0.61)	0.00	0-5	0.00/4.00

Olfactory	0.54 (0.50)	0.00	0-5	0.00/3.00
Taste	0.70 (0.53)	0.00	0-5	0.00/4.00
SAND Interview Hyperreactivity				
Tactile	1.19 (0.76)	1.00	0-5	0.00/4.00
Olfactory	2.14 (1.04)	2.00	0-5	0.00/5.00
Taste	1.77 (0.82)	2.00	0-5	0.00/5.00
SP3D Hyperreactivity				
Tactile	1.36 (1.26)	0.00	0-9	0.00/4.00
Olfactory	0.35 (0.86)	0.00	0-5	0.00/3.00
Taste	0.21 (0.63)	1.00	0-9	0.00/4.00
SSP Hyperreactivity				
Tactile	30.42 (3.60)	31.00	7-35	13.00/35.00
Taste/Smell	17.14 (3.26)	18.00	4-20	8.00/20.00

5.4.2 Recoding of sociodemographic variables

To examine whether any demographic factors should be controlled for in the main analyses, preliminary two-tailed bootstrapped Pearson's correlations were conducted to explore associations between child and maternal sociodemographic factors on the one hand and food fussiness, emotionality, SAND observation, SAND interview, SSP and SP3D questionnaire hyperreactivity on the other.

Sociodemographic variables with more than two categories were recoded into dichotomous variables to allow a comparison between the dominant category and other categories. Child ethnicity was re-coded into "White British" vs. "Other". The majority of child participants were White British, so this represented one category while other ethnic groups, all of which contained relatively few participants, were combined to form a second category labelled “Other Ethnicity”. “Other Ethnicity” was coded as 0 while “White British” was coded as 1.

Marital status was re-coded into “Married/living with partner” vs “Not Married”. The few respondents in the “other” category were either in civil partner relationships or cohabiting, this was combined with the “married” category to represent “Married/living with partner”. Single and divorced categories were combined to represent the “Not Married” group. “Married/living with partner” was coded as 0 while “Not Married” was coded as 1

Maternal employment status was recoded into “Employed” vs “Not Employed”. Employed full time and Employed part time categories were combined to represent “Employed” while Homemaker and Unemployed categories were combined to represent “Not Employed” “Employed” was coded as 0 while “Not Employed” was coded as 1

Maternal Education was re-coded into “No UG Degree” vs. “UG Degree”. Primary school, GCSE, A ‘Level and College Course Certificate were combined to represent “No UG Degree” while bachelor’s degree, Master’s Degree and Postgraduate Degree represented “UG Degree or higher”. “No UG Degree” was coded as 0 while “UG Degree or higher” was coded as 1.

Bootstrapped hierarchical regression analyses were used to investigate whether sensory hyperreactivity explains a proportion of variance over and above emotionality in predicting food fussiness and to explore any interaction effects between emotionality and sensory hyperreactivity in predicting food fussiness. Before performing regression analyses, the predictor variables were centred to avoid multicollinearity between the interaction variable derived from their product. Centering was achieved by deriving a mean score of the predictor variables and subtracting the means from the individual scores. An interaction variable was subsequently created from the product of the centred variables. In each analysis, the dependent variable was food fussiness, maternal age was entered in Step 1 to control for its effect, centred emotionality was entered in Step 2, and then centred sensory hyperreactivity variable was entered in Step 3 to determine if it explained any unique variance over and above emotionality in predicting food fussiness. An interaction variable derived from the product of the centred predictors was entered in Step 4.

Prior to performing regression analyses, bootstrapped partial correlations controlling for maternal age were performed to explore associations between SAND Observation, SAND Interview, SSP and SP3D questionnaire hyperreactivity across taste, tactile and olfactory sensory domains with food fussiness (Table 5.4). To control for the increased risk of Type 1 error due to multiple comparisons, statistical significance was set at a Bonferroni corrected p-value of $p < 0.0125$ (0.05/4). Only significant correlations were entered into the regression analyses.

5.5 Results

Descriptive statistics for the study measures can be seen in Table 5.5. Mean scores on the CEBQ FF subscale for children in this sample are lower than the mean scores obtained from children in Studies 1, 2 and 3 but are however comparable to previous studies that have used this measure with children of a similar age group in the UK (e.g., Ashcroft et al., 2008; Holley, Farrow & Haycraft, 2018). Mean scores for emotional temperament measured using the EAS for children in this sample are also lower than the mean scores obtained from Studies 1 and 3 and from previous studies (e.g., Hafstad et al., 2013) but are comparable with mean scores for emotionality obtained by Powell et al., (2011) from a similar age range Mean scores for taste, olfactory and tactile hyperreactivity measured using the SSP and the SP3D in the current sample of children are comparable with previous studies that have used these measures with typically developing children and reflect typical levels of sensory hyperreactivity (e.g., Schoen et al., 2008; Farrow & Coulthard, 2012). There are no available norms to compare means for tactile, taste and olfactory hyperreactivity measured via SAND observation and SAND interview as the only study that has used this measure in typically developing children (Siper et al., 2017) calculated a mean score for overall hyperreactivity across all sensory modalities.

There was a significant negative correlation between maternal age and child food fussiness (r =. -229, 95% CI -.438 – -.014, p = .042). With increasing maternal age, there was a decline in maternal perception of child food fussiness. There were no other significant relationships between any of the other sociodemographic variables with food fussiness, emotionality, SAND observation, SAND interview, SSP and SP3D questionnaire hyperreactivity. Maternal age was therefore controlled for in all further analyses involving food fussiness.

Correlations between the sensory measures can be seen in Table 5.6. The SAND was significantly negatively related to the SSP, children with higher scores on the SAND indicative of higher sensory hyperreactivity were scored low on the SSP. Lower scores on the SSP is an indication of higher sensory hyperreactivity. Both the SAND and the SSP were unrelated to the SP3D.

As shown in Table 5.7, there was a significant positive correlation between Interview olfactory hyperreactivity and food fussiness (r =.291, 95% CI 0.06 - 0.486, *p* = .009); children perceived by their mothers as having higher olfactory hyperreactivity were also perceived to have greater levels of food fussiness. There was also a significant positive correlation between Interview taste hyperreactivity and food fussiness (r =.459, 95% CI .273 - .622, *p* < .001); children perceived by their mothers as having higher Taste hyperreactivity were also perceived to have greater levels of food fussiness. Taste/smell hyperreactivity as measured by the SSP was significantly negatively related to food fussiness (r =-.575, 95% CI -.719 - -.432, *p* < .001); children with higher scores on the SSP taste/smell sensory hyperreactivity scale (indicating *less* hyperreactivity) were perceived by their mothers as less fussy. In addition, tactile hyperreactivity as measured by the SSP was significantly negatively related to food fussiness (r = -.374, 95% CI -.545 - -.174, *p* = .001). Children with higher SSP tactile hyperreactivity scores (indicative of *lower* levels of hyperreactivity) were perceived by their mothers as less fussy.

Table 5-6 Two tailed bootstrapped correlations between the SAND, SSP and SP3D.

Sensory Measure	SAND	SSP
SAND		-.405**
SSP	-.405**	
SP3D	-.090	.078

****p < .0001**

Table 5-7 Two tailed bootstrapped Partial correlations between child food fussiness with Observed, Interview and questionnaire Sensory hyperreactivity (N = 79).

	Taste	Olfactory	Tactile
SAND Observation Sensory hyper-reactivity	**-.013**	-.086	-.108
SAND Interview Sensory hyperre-activity	.459**	.291*	.243
SP3D Sensory hyperreactivity	.016	-.087	.028
SSP Sensory hyperreactivity	-.575*		-.374**

p* < 0.0125, ** p < 0.001

On the basis of these results, four separate bootstrapped hierarchical regression analyses were performed to investigate whether SAND Interview olfactory, SAND Interview taste, SSP taste/smell and SSP tactile sensory hyperreactivity would each independently explain a proportion of variance over and above emotionality in predicting food fussiness. The hierarchical regression analyses will also explore whether there were any emotionality x SAND Interview olfactory, SAND Interview taste, SSP taste/smell and SSP interaction effects in predicting food fussiness.

5.5.1 SAND Interview olfactory hyperreactivity

A bootstrapped hierarchical regression analysis was conducted with child food fussiness as the dependent variable (See tables 5.8 & 5.9). In Step 1, maternal age contributed significantly to the regression model, F (1, 77) = 4.263, p = .042 explaining 5.2% of variance in food fussiness. Introducing emotionality in Step 2 resulted in a significant change in R^2, F (2, 76) = 8.194, *p* = .001, explaining an additional 12.5% of variance in food fussiness. In Step 3, SAND interview olfactory hyperreactivity explained 5.8% of variance in food fussiness and this change in R^2 was also significant, F (3, 74) = 7.709, *p* = .019. The introduction of the emotionality x SAND interview olfactory hyperreactivity interaction term in Step 4 did not result in a significant change in R^2, F (4, 74) = 5.705, *p* = .991. These results indicate that maternal reported olfactory hyperreactivity explains a proportion of variance over and above emotionality in predicting food fussiness.

Table 5-8 Summary of Bootstrapped Hierarchical Regression Analysis investigating whether olfactory hyperreactivity as measured by SAND maternal interview explains a proportion of variance over and above emotionality in predicting child food fussiness (N = 79).

Step	R	R^2	ΔR^2
1. Maternal Age	.229	.052	.052*
2. Emotionality	.421	.177	.125*
3. SAND Interview olfactory hyperreactivity	.485	.236	.058*
4. Emotionality *SAND Interview olfactory hyperreactivity	.485	.236	.000

***p* < 0.05; ***p* < 0.001**, **ΔR^2= R square change**

Table 5-9 Final model- statistical values for predictors of food fussiness (SAND Interview olfactory hyperreactivity).

Step 4 (Final model)	B	SEB	β	95% CI
Maternal Age	-.037	.018	-.206*	-.074- -.002
Emotionality	.271	.086	.324*	.113 -.415
SAND Interview olfactory hyperreactivity	.112	.048	.224*	.014 -.217
Emotionality * SAND Interview olfactory hyperreactivity	-.001	.055	-.001	.104 -.088

p <0.05; ** p <0.001

5.5.2 SAND Interview taste hyperreactivity

Bootstrapped hierarchical regression analyses were repeated with SAND Interview taste hyperreactivity as the predictor and child food fussiness as the dependent variable (See tables 5.10 & 5.11). Step 1 and 2 are identical across models so aren't repeated here. In Step 3, adding SAND interview taste hyperreactivity to the model explained an additional 14.1% of variance in food fussiness and this R^2 change was significant F (3, 75) = 11.666, p < 0.001. Finally, the introduction of emotionality x SAND interview taste hyperreactivity interaction term in Step 4 only explained 0.1% of the variance in food fussiness and this R^2 change was non-significant, F (4, 74) = 8.654, p = .810. The results indicate that maternal reported taste hyperreactivity explains a proportion of variance over and above emotionality in predicting food fussiness.

Table 5-10 Summary of Bootstrapped Hierarchical Regression Analysis investigating whether SAND interview taste hyperreactivity as measured by maternal interview explains a proportion of variance over and above emotionality in predicting child food fussiness (N = 79).

Step	R	R^2	ΔR^2
1. Maternal Age	.229	.052	.052*
2. Emotionality	.421	.177	.125*
3. SAND Interview taste hyperreactivity	.564	.318	.141**
4. Emotionality *SAND Interview taste hyperreactivity	.565	.319	.001

***p < 0.05; **p< 0.001,* ΔR^2= R square change**

Table 5-11 Final Model- statistical values for predictors of food fussiness (SAND Interview taste hyperreactivity)

Step 4 (Final model)	B	SEB	β	95% CI
Maternal Age	-.029	.018	-.160	-.068 - .007
Emotionality	.217	.084	.259*	.055 -.381
SAND Interview taste hyperreactivity	.217	.056	.390**	.097-.324
Emotionality *SAND Interview taste hyperreactivity	.015	.061	.024	-.079 - .136

p < 0.05; ** p < 0.001

5.5.3 SSP Taste/Smell Hyperreactivity

Bootstrapped hierarchical regression analyses were further conducted with taste/smell hyperreactivity as measured by the SSP as the predictor variable and child food fussiness as the dependent variable (See tables 5.12 & 5.13). In Step 3, adding taste/smell hyperreactivity to the model explained an additional 26.3% of variance in food fussiness and this R^2 change was also significant $F(3, 75) = 19.643$, $p < 0.001$. Finally, the introduction of emotionality x taste/smell hyperreactivity interaction term in Step 4 only explained 1.9% of the variance in food fussiness and this R^2 change was non-significant, $F(4, 74) = 15.716$, $p = .108$. The results indicate the taste/smell hyperreactivity as measured by the SSP explains a proportion of variance over and above emotionality in predicting food fussiness.

Table 5-12 Summary of Bootstrapped Hierarchical Regression Analysis investigating whether taste/smell hyperreactivity as measured by the SSP questionnaire explains a proportion of variance over and above emotionality in predicting child food fussiness (N = 79).

Step	R	R^2	ΔR^2
1. Maternal Age	.229	.052	.052*
2. Emotionality	.421	.177	.125*
3. SSP taste/smell hyperreactivity	.663	.440	.263**
4. Emotionality * SSP taste/smell Hyperreactivity	.678	.459	.019

***p < 0.05; **p < 0.001*, ΔR^2= R square change**

Table 5-13 Final Model- statistical values for predictors of food fussiness (SSP taste/smell hyperreactivity).

Step 4 (Final model)	B	SEB	β	95% CI
Maternal Age	-.023	.016	-.126	-.059 - .008
Emotionality	.218	.073	.260*	.072 -.355
SSP taste/smell hyperreactivity	-.123	.020	-.529**	-.161- -.089
Emotionality * SSP taste/smell hyperreactivity	.042	.026	.140	-.015 - .090

p < 0.05; ** p < 0.001

5.5.4 SSP tactile hyperreactivity

Finally, a bootstrapped hierarchical regression analyses was repeated with tactile hyperreactivity as measured by the SSP as the predictor and child food fussiness as the dependent variable (See tables 5.14 & 5.15). Adding tactile hyperreactivity to the model in Step 3 explained an additional 7.2% of variance in food fussiness and this R^2 change was also significant F (3, 75) = 8.314, *p* = 0.009. Finally, the introduction of emotionality x tactile hyperreactivity interaction term in Step 4 only accounted for 2% of the variance in food fussiness and this R^2 change was non-significant, F (4, 74) = 6.811. *p* = .164. The results indicate the tactile hyperreactivity as measured by the SSP explains a proportion of variance over and above emotionality in predicting food fussiness.

Table 5-14 Summary of Bootstrapped Hierarchical Regression Analysis investigating whether tactile hyper-reactivity as measured by the SSP questionnaire explains a proportion of variance over and above emotionality in predicting child food fussiness (N = 79).

Step	R	R^2	ΔR^2
1. Maternal Age	.229	.052	.052*
2. Emotionality	.421	.177	.125*
3. SSP tactile hyperreactivity	.500	.250	.072*
4. Emotionality * SSP tactile hyperreactivity	.519	.269	.020

***p < 0.05; **p < 0.001,* ΔR^2= R square change**

Table 5-15 Final Model- statistical values for predictors of food fussiness (SSP tactile hyperreactivity).

Step 4 (Final model)	B	SEB	β	95% CI
Maternal Age	-.024	.018	-.133	-.066 -.015
Emotionality	.228	.088	.284*	.063 -.403
SSP tactile hyperreactivity	-.076	.025	-.361*	-.121- -.023
Emotionality * SSP tactile hyper-reactivity	.031	.022	.158	-.010 - .081

p <0.05; ** p <0.001

5.6 Discussion

The aim of this study was to investigate associations between food fussiness and sensory hyperreactivity in children across taste, tactile and olfactory sensory domains. In addition, the present study aimed to evaluate whether these associations remained after controlling for the effects of emotionality. This study further explored the role of a possible interaction between emotionality and sensory hyperreactivity in predicting food fussiness.

Consistent with the hypothesis, the present study found maternal reported tactile, taste and olfactory sensory hyperreactivity to be significantly positively associated with maternal-reported food fussiness. This corroborates previous findings that sensory hyperreactivity in tactile, taste and olfactory sensory domains is related to food fussiness (e.g., Farrow & Coulthard, 2012; Zucker et al., 2015). As previously discussed in chapter one (p. 73), children with higher levels of sensory hyperreactivity have lower thresholds for detecting sensory information and are able to easily detect subtle changes in the sensory properties of food (Farrow & Coulthard, 2012). Children tend to reject food on the basis of the taste, look, smell and texture of food (Coulthard, Palfreyman, & Morizet, 2016). Fussy eaters have been observed to reject food based on certain sensory properties, for example, to spit out food due to a dislike of the taste and/or texture (Fries et al., 2017; Luchini et al., 2016). This finding was replicated in Study 2 (pp. 118-143) where children perceived by their mothers as being fussy were also observed to reject food based on smells, they presumably found unappealing. It makes sense therefore that children who are able to easily detect the taste, olfactory and tactile properties of food might be more likely to be fussy eaters.

The present research extended previous research by examining whether tactile, taste and olfactory sensory hyperreactivity explained variance in fussy eating over and above higher emotional temperament. The findings indicated that maternal reported tactile, taste and olfactory sensory hyperreactivity explained an additional 5.8-26.3% variance in food fussiness that was not due to emotionality. These results highlight the importance of sensory hyperreactivity in tactile, taste and olfactory sensory domains in explaining child food fussiness. Importantly, the effect of emotionality remained significant after sensory hyperreactivity was included as a predictor. Taken together, these results therefore indicate that children with higher emotionality and sensory hyperreactivity are more likely to be perceived by their mothers as fussy eaters. Mealtimes could be particularly challenging for children with higher emotional temperament who are also highly sensitive. Such children are likely to find various foods disgusting due to their sensory properties and may be more likely to reject these foods and/or resist trying or eating them when offered. Given the likely challenges arising from these characteristics, mothers may find mealtimes very difficult, and this may lead them to use a range of strategies to encourage food consumption including controlling feeding practices such as use of pressure, food rewards and prompts. As previously discussed in chapter one (pp 69-76), controlling feeding practices have been found to be associated with food fussiness in cross-sectional (e.g., Jansen et al., 2012; Webber, Cooke, Hill, & Wardle, 2010) and longitudinal studies (e.g., Galloway et al., 2005). These findings were replicated in Study 3, chapter four, where a positive association was found between food fussiness and maternal use of pressure, physical prompt and food rewards. Explanations for this association are that controlling feeding practices could worsen food fussiness, resulting in increased parental perception of food fussiness (Blissett, 2011; Dovey et al., 2008). Alternatively, some parents may try to avoid the conflict associated with pressuring children with higher emotional temperament and sensory hyperreactivity to eat disliked foods and may adapt a more permissive approach, providing foods their children prefer which, as discussed in Chapter one (p. 58), may reinforce food fussiness as children are not exposed to a variety of foods, and may also result in increased parent perception of food fussiness.

The present study found no significant interactions between emotional temperament and sensory hyperreactivity across tactile, taste and olfactory sensory domains in predicting food fussiness. This finding indicates that emotional temperament and sensory hyperreactivity independently influence food fussiness in an additive way. The relationship between each of these variables and food fussiness is not dependent on the level of the other variable.

Although the findings from this study provide support for the main hypotheses, some were unexpected findings. First, no significant associations were found between observed sensory hyper-reactivity on the SAND and food fussiness. Previous studies have found associations between observed tactile hyperreactivity and food fussiness (e.g., Nederkoorn, Jansen, & Havermans, 2015; Werthmann et al., 2015) but, to the best of our knowledge, there is no research examining links between behavioural measures of taste and olfactory hyperreactivity and food fussiness. The discrepancy between the present findings and those showing an association between food fussiness and observed tactile hyperreactivity may be due to the fact that in previous studies reporting this association, both food fussiness and sensory hyperreactivity were assessed via observation. In this study, food fussiness was assessed via maternal self-report. As parent-report measures are open to bias, it is possible that in this study mothers' accounts of their children's food fussiness were not accurate reflections of their child's actual eating behaviour.

A related unexpected finding was that scores from the observation version of the SAND and the interview version were not correlated. We considered the inclusion of observation as well as parent report of sensory hyperreactivity a strength of the present study but this discrepancy was not anticipated as a previous study (Siper et al., 2017) found SAND observed scores to be significantly correlated to SAND interview scores. This indicates that in our sample, maternal accounts of children's sensory hyperreactivity were not validated by independent observations of children's sensory hyperreactivity. A possible interpretation of this finding is that mothers provided accurate responses regarding their children's sensory processing and children responded uncharacteristically during the sensory hyperreactivity test due to being observed. This interpretation is plausible given that children were observed in a lab environment in the presence of two unknown researchers and observations were videotaped, factors that may have influenced their behaviour. Mothers tend to be the primary caregivers , likely to interact with their child on several occasions and are therefore in a strong position to provide a reliable assessment of their children's behaviour (Carnell & Wardle, 2007). Alternatively, it is also possible that children's responses to stimuli in the sensory hyperreactivity test may reflect their actual behaviour and mothers' responses were biased. That maternal report and observation did not correlate is key to this study because only maternal report was significantly associated with fussy eating. Given that fussy eating was also measured via maternal report, the finding should be treated with caution. It is also possible that significant associations were found because of shared method-variance.

Discrepancy between maternal-report and observed behaviour in general are not uncommon. While a few studies have found responses on maternal - reported measures to be accurate reflections of independent observations of their children's behaviour (e.g., Carnell & Wardle, 2007; Cooper et al., 2004), others have found maternal-reported measures to be poorly related to independently rated observations (e.g., Farrow, Blissett, & Haycraft, 2011; Haycraft & Blissett, 2008; Lewis & Worobey, 2011). It would be of merit if future research evaluating maternal-reported sensory hyperreactivity with independent observations of children's sensory hyperreactivity was conducted in children's home environments. This may lead to behaviours from children that are likely to be more typical.

A third unexpected finding was that sensory hyperreactivity measured using the SP3D scales was not associated with food fussiness. As previously discussed, the inclusion of this scale was to validate responses on the SAND and SSP as the items assessing taste hyperreactivity on these measures were closely related to food fussiness while SP3D taste hyperreactivity items were unrelated to food fussiness. Inconsistent findings between taste hyperreactivity and food fussiness measured via the SP3D, SAND and SSP suggests that associations between SAND and SSP taste hyperreactivity and food fussiness may be as a result of item overlap between food fussiness and these sensory measures. Consequently, the relationships between food fussiness and taste hyperreactivity must be interpreted with caution because the items measuring taste hyperreactivity in the SAND and the SSP are so closely related to food fussiness. This closeness may explain the high correlations between SAND and SSP taste/smell hyperreactivity with food fussiness and the large proportion of variance explained by taste/smell hyperreactivity assessed through the SAND and SSP in food fussiness scores

While these findings contribute to our understanding of the relationships between sensory processing and food fussiness, this study is not without its limitations. The generalizability of the findings is limited to predominantly white British children from two-parent households, and further research is needed to explore whether the present findings can be replicated with children from other ethnic and demographic backgrounds. It is also important to note that the cross-sectional nature of the present study prevents any inferences about causality. While emotional temperaments and sensory hyperreactivity have been identified as potential risk factors for the development of food fussiness, further research exploring these relationships using longitudinal designs is required to determine whether these risk factors are indeed causal.

5.7 Conclusion

The present study demonstrates that highly sensory hyperreactive children who also have higher emotional temperaments are most likely to be fussy eaters. This finding is important because if children who are at risk for the development of food fussiness are identifiable, the use of early preventive interventions could deter the development of food fussiness in such children. Moreover, children with these characteristics identified as being at risk could be prioritised for interventions aimed at addressing food fussiness.

Chapter 6: Synthesis

Food Fussiness is the rejection of familiar and novel foods leading to consumption that is insufficient and/or inadequately varied. Food fussiness has been found to have negative implications for children’s current and future health, including functional constipation in childhood (e.g., Tharner et al., 2015) and the increased risk of eating disorders in adolescence and adulthood (e.g., Marchi & Cohen, 1990). Food fussiness has also been found to have a negative impact on family relationships and lead to parental stress (Goh & Jacob, 2012; Trofholz et al., 2017). Given these negative consequences and evidence of its persistence into late childhood and adulthood (e.g., Ashcroft et al., 2008; McDermott et al., 2010), prevention and developing interventions to address food fussiness is important. To do this effectively we need better understanding of the risk factors that underpin food fussiness. Previous research has identified child temperament, child sensory hyperreactivity, maternal psychopathology, maternal core beliefs and maternal controlling feeding practices as significant correlates and risk factors for food fussiness (e.g., Hafstad et al., 2013, Farrow & Coulthard, 2012; Jansen et al., 2012; Blissett et al, 2005; Debarse et al., 2016). However, there is a lack of studies examining these factors together in a single study in order to determine which are most important. Farrow and Blissett (2006) examined the contribution of child temperament, maternal psychopathology and maternal core beliefs to the prediction of food fussiness in six-month-old infants, however parents report less food fussiness in six months old infants, typically food fussiness doesn’t not concern parents until children’s second year (Carruth et al., 2004; Hafstad et al., 2013). Research examining these predictors in an age group associated with increased parental perception of food fussiness was of merit, therefore.

The principal objective of this thesis was to explore food fussiness in children aged 2-4 years in relation to child and maternal factors. The thesis comprised four studies: 1) a cross-sectional survey of 174 mothers that demonstrated children’s emotionality is a strong predictor of food fussiness, 2) an observational study of 67 mother-child dyads that validated the food fussiness subscale of the CEBQ, 3) an observational study that revealed maternal use of verbal pressure and physical prompts moderated the relationship between food fussiness and higher emotionality, 4) a second observational study including 79 children, which indicated tactile, taste and olfactory hyperreactivity explained variance in food fussiness over and above emotionality. The key findings from each of these studies will now be highlighted and reflections on broad themes that emerge from the research will be discussed. The focus of these reflections will be on the implications of the research for the development of interventions to prevent and address child food fussiness.

6.1 Summary of findings

6.1.1 Key findings

Study 1 examined relationships between child temperament, maternal core beliefs, maternal self-esteem, maternal psychopathology and food fussiness in young children. It was hypothesised on the basis of previous research that higher scores on emotional and shy temperament scales would predict maternal reported child food fussiness. It was also hypothesised that higher depression, anxiety and stress scores, higher unhealthy maternal core beliefs and lower maternal self-esteem scores would predict maternal reported child food fussiness. Higher emotional temperament, lower shy temperament, lower maternal subjugation beliefs predicted food fussiness in a regression analysis. Although the present study found maternal depression, anxiety and stress to be positively related to food fussiness, maternal psychopathology did not significantly predict food fussiness after the influence of child temperament and maternal core beliefs had been accounted for. The key finding of Study 1 was that emotional child temperament emerged as the strongest predictor of child food fussiness in children aged 2-4 years when it was considered alongside maternal psychopathology and maternal core beliefs in a single study. However, it should be noted that other factors which have been previously identified as significant correlates and risk factors such as parents feeding practices and children's sensory processing for food fussiness were not considered in Study 1. Therefore, further research elucidating how emotionality relates to, and is affected by these risk factors of child food fussiness is warranted and was undertaken in Studies 3 and 4. Study 1 used a survey research methodology to examine child temperament, maternal core beliefs, maternal depression, anxiety and stress and maternal self-esteem in relation to food fussiness. As previously highlighted, assessing food fussiness via parent-report is reliant on parents' perceptions of food fussiness which may be varied and subject to bias (e.g., Boquin, Moskowitz, Donovan & Lee, 2014). To address this weakness, Study 2 used a mixed method approach where observations of children's eating behaviour were used to assess food fussiness and validate mother's responses on the CEBQ.

Study 2 aimed to validate mothers' responses on the food fussiness subscale of the CEBQ (Wardle et al., 2001) with independent observations of children's eating during a video-recorded meal at home. It was hypothesised that higher scores on the Food Fussiness subscale of the CEBQ would be associated with more food rejection, less food acceptance, less consumption of familiar and unfamiliar foods and longer meal duration. Supporting the hypothesis, children whose mothers reported greater levels of food fussiness displayed more mealtime behaviours associated with food rejection, fewer mealtime behaviours associated with food acceptance and consumed smaller proportions of familiar foods during the observed mealtime. However, contrary to predictions, maternal reported food fussiness was not associated with the proportion of unfamiliar foods consumed by the child. This was attributed to floor effects, children consumed very little unfamiliar food. Also contrary to predictions, maternal reported food fussiness was not associated with meal duration. Overall the findings from Study 2 validated the food fussiness subscale of the CEBQ as an accurate measure of food fussiness.

Higher emotional child temperament emerged as the strongest predictor of food fussiness over other child temperament dimensions, maternal core beliefs and maternal psychopathology in Study 1. However, it has remained unclear how higher emotional temperament interacts with other risk factors to influence food fussiness in young children. Study 3 and Study 4 examined maternal feeding practices and sensory hyper-reactivity respectively.

It has previously been proposed that parental feeding practices may exacerbate the risk for food fussiness conferred by higher emotionality (e.g., Hafstad et al., 2013; Haycraft et al., 2011). Study 3 therefore explored whether the use of feeding practices aimed at encouraging food consumption may negatively impact children with higher emotional temperament. Specifically, the study investigated whether the association between child food fussiness and higher emotionality is moderated by maternal use of controlling feeding practices, namely use of verbal pressure, physical prompts, food rewards and non-food rewards. Consistent with the hypothesis and previous research, maternal use of pressure, physical prompts and food rewards were positively associated with food fussiness, and maternal use of non-food rewards was negatively associated with food fussiness. Further, there was a significant interaction between emotional temperament and controlling feeding practices, specifically use of verbal pressure and physical prompts, the relationship between child food fussiness and higher emotional temperament was stronger when mothers used more verbal pressure and physical prompts. While it had previously been proposed that higher emotionality in children could lead to difficult parent- child feeding interactions and parental use of maladaptive feeding practices, which could influence food fussiness (e.g., Hafstad et al., 2013), to the best of our knowledge, this is the first study to explore and demonstrate that an interactive model of controlling feeding practices of pressure and physical prompts and emotional temperament negatively influences food fussiness.

Study 4 aimed to investigate the relationship between food fussiness and sensory hyperactivity and in particular to determine whether any associations remain after controlling for child temperament. It was hypothesized based on previous research that higher sensory hyperreactivity in taste, tactile and olfactory sensory domains would be positively associated with food fussiness. Given the lack of previous research examining sensory hyperreactivity and emotionality together in the context of food fussiness, it was tentatively hypothesised that sensory hyperreactivity would be related to food fussiness even after controlling for emotionality. Consistent with the hypothesis and corroborating previous findings, tactile, taste and olfactory sensory hyperreactivity were found to be significantly positively associated with food fussiness. In addition, this sensory hyperreactivity explained variance in fussy eating over and above emotional temperament. However, it should be noted that only maternal reported sensory hyperreactivity in tactile, taste and olfactory sensory domains were found to be significantly related to food fussiness, and associations between observed sensory hyperreactivity in these sensory domains and food fussiness were non-significant. It is possible that significant correlations between maternal reported sensory hyperreactivity across these domains and food fussiness, which was also measured via maternal report, could be attributed to common method variance. Important to interpreting the strong relationship between taste hyperreactivity and food fussiness are the following considerations. First, the close relatedness between the items assessing food fussiness and the items assessing taste hyperreactivity measured via the SSP (Dunn et al., 1999) and the SAND (Siper et al., 2017) raises concern that associations between these two constructs may be as a result of an overlap between the items in the measures used to assess them. Second, the lack of an association between food fussiness and taste hyperreactivity measured via the SP3D (Schoen et al., 2008), which was included as an additional sensory processing measure to validate responses on the SSP and SAND, casts doubt on whether a true relationship exists between taste hyperreactivity and food fussiness. Given these caveats, the finding of a significant taste hyperreactivity and food fussiness relationship must be interpreted with caution.

Findings from this thesis contributes to the literature on emotion regulation. The concept of emotion regulation refers to efforts or strategies individuals use to influence the expression and experience of their emotion (Gross, 1999). There is evidence that parents engage in using food to soothe emotionality in children thereby regulating their emotional states (e.g., Musher- Eizenman & Holub, 2007). The findings from Study 3 where mothers' use of food rewards failed to moderate the relationship between food fussiness and emotional temperament could be explained via an emotion regulation pathway. The use of food rewards may have been comforting to children with higher emotional temperament and consequently regulated their emotional states. Mothers' use of food rewards was unlikely to elicit emotionally charged responses from children with higher emotionality, regardless of the frequency of use, and therefore have no influence on maternal perception of food fussiness as found in Study 3.

Findings from this thesis can be understood from a socio-ecological perspective. Socio-ecological model (SEM) posits that behaviour is influenced by multiple levels of influence and individual behaviour shapes and is shaped by the social environment (Townsend & Foster, 2013). The SEM highlights the interaction and interdependence between factors across all levels of health behaviours including feeding and emphasises that environmental factors impact on individual differences to explain behaviours (Townsend & Foster, 2013). The socio-ecological model is useful for providing a good understanding of the multiple factors that influence eating behaviours and can provide guidance for developing interventions (Robinson, 2008). Findings from this thesis demonstrate that child food fussiness is related to higher emotional child temperament, sensory hyperreactivity and mothers' use of controlling feeding practices. Study 1 found higher emotional temperament in children (individual behaviour) to be the strongest predictor of child food fussiness. However, findings from Study 3 demonstrated that mother's use of verbal pressure and physical prompts (social environment) moderated the relationship between higher emotional temperament and food fussiness. Taken together these findings highlights the integration of individual and environment factors as important in explaining food fussiness and is consistent with the socio-ecological model.

This thesis has several limitations. This thesis could be criticised for the decision to only include the Food Fussiness subscale of the CEBQ as a measure of child food fussiness. More information regarding children's eating behaviour in general would have been gleaned if the overall CEBQ scales had been administered to mothers or the food avoidance scales had been scored as factor. For example, scoring the overall CEBQ would have provided information regarding a range of other eating behaviours measured by the CEBQ in addition to food fussiness. In line with Tharner et al.

(2014), a fussy eater's profile should comprise a combination of high scores on food avoidance scales of the CEBQ and low scores on food approach scales. The food avoidance subscales of the CEBQ measure food fussiness (FF), slowness in eating (SE) which evaluates the pace at which the child eats food, emotional under-eating (EUE) which assesses the child's tendency to eat in response to negative emotions and satiety responsiveness (SR) which measures the child's ability to regulate food intake in relation to satiety. Scoring food avoidance subscales as a factor would have provided an opportunity to measure a wider range of eating behaviours that may be related to poor dietary intake especially in Study 2 where children's eating behaviour was observed. For example, the Satiety Responsive scale would have enabled the differentiation between fussy eaters with greater or lesser appetite. Another limitation is the failure to include a food neophobia scale and a food frequency questionnaire. As food neophobia and food fussiness are considered as two separate constructs (Dovey et al., 2008), the inclusion of a food neophobia would have been useful to ascertain whether mothers differentiate between food fussiness and food neophobia. Such information would help determine if a mother's perception of food neophobia in her child also extends to the categorization of the child as a fussy eater on the FF scale of the CEBQ. A food frequency questionnaire would have provided information on children's food intake and the types and groups of foods accepted and rejected by fussy eaters. The inclusion of a food frequency questionnaire would have also contributed to the validation of mother's responses on the food fussiness scale. This highlights the need for future replications to include all subscales of the CEBQ to assess food fussiness, include additional measures of children's food intake as well as measure food neophobia alongside food fussiness.

There is evidence that mothers with eating disorders (e.g., Bulimia Nervosa and Anorexia Nervosa) rate their infants' temperament higher on negative emotionality than mothers without eating disorders (e.g., Zerwas et al., 2012). Given this, the fact that mothers' eating psychopathology was not measured and controlled for in this thesis is a limitation as it may have influenced mother's responses on the emotionality subscale of the EAS. Future research should measure and control for maternal eating psychopathology when measuring emotional child temperament.

This thesis is also limited by its use of maternal report to measure child temperament which was not validated against observational measures of child temperament. While child temperament has mostly been assessed by parent-report questionnaires, there is debate regarding the validity of parent report of child temperament (e.g., Rothbart & Bates, 1998; Kagan, 1998). One reason for questioning parent's reliability when responding on child temperament questionnaires is the confounding influence parents' characteristics may exact on their responses (Stifter, Willoughby & Goodman, 2008). It has been suggested that parental factors may alter parent perceptions of their child's behaviour and interfere with their ability to identify and report accurately on their actions and emotional responses (Stifter et al., 2008). There are several studies that have found a link between parents' personality and stress with child temperament ratings (e.g., Mebert, 1991; Sameroff, Seifer & Elias, 1982). In addition, as highlighted in the preceding chapter, maternal eating psychopathology has been found to associated with higher ratings of infant negative emotionality (e.g., Zerwas et al., 2012). Observational approaches provide real-time feedback on behaviour that are not subject to biased responses obtained from parent-report. For example, the Minnesota Preschool Affect Checklist Revised (MPAC-R; Denham, Zahn-Waxler, Cummings & Iannotti, 1991) is an observational tool used that was created to evaluate children's positive and negative emotional expression in naturalistic settings. Using the MPAC-R, children's behaviours are observed in differing play and interaction contexts and coded for negative and positive displays of emotion i.e. facial, vocal and bodily emotion. Negative and positive expressions are also coded such as anger, frustration, sadness for negativity and smiling, laughing, singing, dancing for positivity. The MPAC-R has been shown to be valid in capturing children's emotional expression in a number of samples (e.g. Denham et al., 1991; Denham & Burton, 1996). It is recommended that future replications should include observational measures of children's negative tone as an indicator of emotional child temperament to validate parent's responses on questionnaires.

This thesis is further limited by not obtaining sibling information from mothers therefore not knowing if children had siblings or were from one-child families. There is evidence to suggest that having siblings results in increased food acceptance and a decrease in food fussiness in young children (e.g., Burt & Hertzler, 1978; Hafstad et al., 2013). Obtaining sibling information may have revealed differences in mothers' perception of food fussiness in children with siblings and those from one-child families across all four studies. It is recommended that sibling information is obtained in future replications.

6.1.2 Sociodemographic factors and food fussiness

The association between child and parent sociodemographic variables and food fussiness has been investigated in several studies. In early childhood, children's age has been found to be significantly positively correlated with food fussiness, parents have an increased perception of food fussiness from children's second year up to around age six years (e.g., Carruth et al., 2004; Hafstad et al., 2013), when there is a reported decline in parents perception of food fussiness (e.g., Cardona-Cano et al, 2015). A few studies have investigated the relationship between children's gender and food fussiness. While null findings were generally reported in these studies, Marchi and Cohen (1990), in their prospective study following fussy eaters from childhood to adolescence, found that parents perceived girls to be fussier than boys across all age groups. A similar finding was reported by Cao et al. (2012) who also found girls were perceived by their parents as more fussy than boys. Socio-demographic characteristics have also been investigated, with lower maternal education and lower socioeconomic status found to be associated with increased food fussiness (Cardona Cano et al., 2015; Migraine et al., 2013). Given these findings, child and maternal sociodemographic variables were assessed across studies in this thesis so that these factors could be controlled for if necessary. The sociodemographic data obtained included children's gender, age and ethnicity; maternal age, ethnicity, marital status, education and employment status. Across studies there were inconsistent findings regarding the relationship between sociodemographic variables and food fussiness. Study 1 found maternal education and marital status to be significantly related to child food fussiness, with higher maternal education and single mothers reporting greater food fussiness. However, these relationships were not replicated in the other studies within this thesis. Studies 2 and 3 did not find significant associations between any of the measured sociodemographic variables and food fussiness, while Study 4 found that younger mothers reported greater child food fussiness. Significant relationships between sociodemographic variables and food fussiness found in Study 1 could be attributed to the larger sample size (N = 162) which may have yielded sufficient statistical power to detect small effects. However, as the sample size in Studies 2 and 3 (N = 67) was only enough to detect medium effects, non-significant associations between sociodemographic variables and food fussiness in this sample might be because of insufficient power to detect smaller effects. Significant associations between maternal age and food fussiness were however found in Study 4 where the sample size (N = 79) was slightly more than that of Studies 2 and 3. These inconsistencies suggest that sociodemographic variables may play a complex role in child food fussiness, or no role at all. Further investigation to clearly determine their role would be of merit as it would justify and clarify the need for targeted interventions. For example, an intervention targeting obese children from lower socioeconomic backgrounds was found to have a positive impact on obesity prevention (Willis et al., 2014). Although there were inconsistent findings between socioeconomic status and food fussiness across all studies within this thesis, it should also be noted that there are limitations to its measurement as maternal education and employment status were used as proxy to determine socioeconomic status. In addition, the homogenous sample of White, British mothers in this thesis reduced the likelihood of finding effects.

6.1.3 Use of parent-report v. observation

Much of the research on child food fussiness, parent-child feeding interactions and sensory processing has relied on the use of parent self-report measures. This method has the advantage of being a cost-effective means of obtaining responses from a large and diverse group of people. The main disadvantage of the use of parent-report however is that responses may be subject to bias and subjective perceptions. The use of parent report to assess food fussiness may be influenced by overestimation and recall biases, for example, as previously discussed in Chapter one (p. 8), some parents may be excessively concerned about their child's food fussiness and may overestimate behaviours related to food fussiness in parent-report measures (e.g., Boquin, Moskowitz, Donovan, & Lee, 2014). Also, some items on several food fussiness parent-report questionnaires asks parents to indicate whether their child displays specific eating behaviours and are based on retrospective parental evaluations of the child's eating behaviour which may be subject to recall bias. In addition, Boquin, Simpson, Donovan, & Lee, (2014) found that parents had subjective and varying perceptions of food fussiness and provided fluctuating responses to the same question enquiring about their child's food fussiness status. Findings on the reliability of parent-report as an accurate reflection of children's behaviour are mixed. For example, while some studies have found that mothers provide accurate accounts of their child's eating and feeding interactions (e.g., Cooper et al., 2004; Fries et al., 2017; Whelan & Cooper, 2000), others have found that parent-report is not validated by independent observations of children's eating and parent-child feeding interactions (e.g., Haycraft & Blissett, 2008; Werthmann et al., 2015). While observational measures might not be influenced by the biases associated with parent-report, they might be influenced by social desirability biases and demand characteristics. This is because participants are usually informed they are being observed, and consequently they might act uncharacteristically and in ways that are deemed socially desirable under these circumstances. It can therefore be argued that observational measures are limited in their ability to capture participants' "natural" behaviour. Advantages of the use of observational measures, however, include the ability to capture and evaluate detailed information that participants may be unaware of or be unwilling to report as well as behaviours that may not be easily assessed using self-report measures.

This thesis employed a mixed method approach using both maternal report and observational measures which mitigate some of the strengths and limitations associated with these methods. In Study 1, child food fussiness was assessed via maternal report, using the food fussiness subscale of the CEBQ. This method was a convenient means to obtain responses from the large number of respondents who participated in this study. To validate maternal responses on the food fussiness subscale against observations of children's eating, Study 2 measured food fussiness using both parent report and observational measures. Study 4 measured sensory processing using both self-report and observational methods where children's reactions to the presentation of sensory stimuli were independently observed. This allowed first-hand experience of observing children's behaviours such as their approach and reaction to liked and disliked stimuli which may not always be measurable using parent-report measures as well as an opportunity to validate maternal responses on the corresponding sensory processing questionnaire. Maternal reported food fussiness was found in Study 2 to correspond to independent observations of children's fussy eating, supporting the use of the CEBQ to accurately measure food fussiness throughout this thesis. However, in Study 4, maternal reported sensory hyperreactivity was not associated with observations of children's sensory hyperreactivity. Although it is assumed that parents should be in a strong position to provide accurate accounts of their children's behavioural traits, as they usually have privileged observational access to a repertoire of their children's behaviours (Carnell & Wardle, 2007), non-correspondence between that maternal-reported and observed sensory hyperreactivity suggests mothers are not always accurate in their reports of their child's behaviour. This finding highlights the need for future research to assess children's behaviours using observational approaches with the aim of validating parent report. It can be suggested that future research should assess children's sensory hyperreactivity in a more naturalistic setting such as in the home environment as the laboratory setting may have altered children's typical behaviour. Emotional child temperament was assessed solely by maternal report throughout this thesis. As previously discussed earlier on pp. 207-208, parental report of child temperament may be influenced by parent's personality and psychological factors. Future research should therefore use a mixed method approach incorporating observations of children's emotional tone to validate parent-report questionnaires.

6.1.4 Overarching summary of findings

Findings from the studies described in this thesis highlight the significance of emotional child temperament in children's food fussiness. Findings are also consistent with the possibility that maternal use of verbal pressure and physical prompts may be particularly detrimental for children with higher emotional temperaments and could lead to increased maternal perception of child food fussiness. Children's sensory hyperreactivity in tactile, olfactory and taste sensory domains were found to be important explaining a proportion of variance over and above emotional temperament in explaining child food fussiness. Inconsistent findings in the relationship between parent and child sociodemographic variables and food fussiness throughout this thesis indicate that sociodemographic variables may not necessarily be important for the development of food fussiness. Although maternal reported food fussiness was validated by observations of children's food fussiness supporting the use of the parent-report food fussiness questionnaire to reliably measure fussy eating, mothers' responses on the sensory processing questionnaire was unrelated to observed child sensory processing. This suggests that mothers' responses on parent-report questionnaires may not always reflect children's observed behaviour, supporting the use of both parent report and observational approaches to assess child sensory processing in this thesis.

6.2 Implications for prevention and intervention

The finding of a correspondence between maternal reported scores on the food fussiness subscale of the CEBQ and observed child food fussiness in Study 2 is important for researchers and health practitioners working with families of fussy eaters who could confidently use this parent-report measure to assess child food fussiness.

The key finding of Study 3, that the use of pressure and physical prompts exacerbates the risk conferred by emotional temperament, has implications for intervention. Child temperament is an intrinsic child characteristic and a therefore relatively stable trait while parent feeding practices are modifiable. Thus, health professionals working with families of fussy eaters could target parent feeding practices in interventions. Indeed, interventions where parents have been educated to use adaptive feeding practices such as modelling, repeated exposure and positive reinforcement and to avoid the use of pressuring feeding strategies have led to a reduction of food fussiness and an increase in the range of foods accepted by fussy eaters (e.g., Fraser, Wallis, & John, 2004; Haywood & McCann, 2009). To date, these interventions have not considered child temperament, but the findings of Study 3 suggest that the effects might be stronger in children with emotional temperaments. Therefore, similar interventions targeted at feeding practices that work well with emotional temperaments might be more effective for children higher on emotionality and would make for an interesting avenue for future research.

Study 4 findings indicate that children with higher emotional temperament who are also hypersensitive are likely to become fussy eaters. Interventions could also focus on targeting these characteristics as a mechanism for decreasing fussy eating. As previously discussed, while emotionality is enduring and not easily modified, it may be possible to target hypersensitivity and desensitise children by exposing them to the sensory properties of foods. The principle behind this strategy stems from the mere exposure hypothesis (Zajonc, 1968) which proposes that the outcome of familiarisation with a stimulus is a positive attitude towards the particular stimulus where repeated exposure to the taste of disliked foods has been shown to increase liking (e.g., Wardle, Herrera, Cooke, & Gibson, 2003). However, because children may be unwilling to place disliked foods in their mouths, exposing them to other sensory properties of food, such as the feel and smell of foods, without tasting may promote willingness to taste these foods (Nederkoorn et al., 2018). A few studies have demonstrated that tactile exposure to food texture increases food acceptance. For example, Nederkoorn et al. (2018) found that exposing children to the texture of odourless and colourless jelly with their hands later increased their acceptance of a dessert with a similar texture. In addition, as previously discussed in Chapter one (pp. 79-80), visually exposing young children to a picture book depicting images of novel foods influenced their willingness to taste new foods (Houston-Price, Butler & Shiba 2009). However, the long-term benefits of these interventions are unknown therefore longer-term studies are warranted to determine if these effects can be sustained over time. In addition, children's tactile and visual sensitivity were not measured in these studies, therefore the children in this study might have had typical levels of tactile and visual responses and it is unclear how children with tactile and visual hyperreactivity would respond to this task. This represents an interesting question for future research aimed at decreasing children's food fussiness. Future interventions targeting hypersensitive and highly emotional temperamental children could incorporate adaptive feeding practices and sensory exposure approaches to address food fussiness. In three separate samples within this research, emotional child temperament was significantly related to child food fussiness. This finding suggests that children who have higher emotional temperament are likely to become fussy eaters compared to children who do not, therefore early interventions focusing on these children could prevent the development of food fussiness.

6.3 Directions for future research

The research conducted has identified a number of areas requiring further investigation including the need to consider maternal eating behaviour as well as the importance of studying diverse groups and conducting longitudinal research. These will now be discussed.

6.3.1 Maternal eating behaviour

An important covariate that may play a role in children's eating and maternal feeding practices is mothers' eating behaviour. Maternal eating behaviour has been found to be related to children's eating behaviour. For example, Francis and Birch (2005) found mothers' preoccupation with their weight and eating to be associated with their daughters restrained eating. In this study, Francis and Birch (2005) found that mothers who were concerned about their own weight also had high levels of concern about their daughters' weight and reported using higher levels of restrictive feeding practices and greater verbal encouragements to lose weight. Consequently, these maternal behaviours were found to be associated with daughters' restricting their food intake as a means of reducing their weight.

The relationship between maternal food neophobia and child eating has also been investigated. For example, Galloway et al. (2003) found high maternal food neophobia scores significantly predicted food neophobia in children aged 7 years. Similarly, Cassells, Magarey, Daniels andMallan (2014) found a positive association between child food neophobia and the percentage of fruits and vegetables disliked by the mother. It is therefore plausible that a mother's food fussiness could also have an influence on her child's eating and the feeding practices she uses during mealtimes. This link between mothers' fussy eating and children's fussy eating could develop for several reasons. Mothers who are currently fussy eaters may provide a less varied diet for their children, resulting in limited opportunity for their children to try different foods thus increasing food fussiness. In addition, mothers who were fussy eaters as children but now enjoy a varied diet in adulthood may not perceive their child's food fussiness as a problem. Such mothers may view food fussiness as a phase their child will eventually outgrow, as they did, and may not use any strategies to encourage consumption of disliked foods, resulting in increased child food fussiness.

Maternal fussiness was not assessed in the studies included in this thesis. It is therefore possible that maternal fussiness might have affected the findings. For example, in Studies 2 and 3, maternal food fussiness may have influenced children's mealtime duration and mothers' use of feeding practices during the observed mealtime. Mothers who were currently fussy eaters may also have disliked some of presented foods and therefore used fewer feeding practices to encourage food consumption in their children. Our data indicated that there were only two cases of mothers who made negative food comments about some of the presented foods they disliked. Although not subject to analysis, video recordings showed that these mothers did not encourage their children to consume the food, which may have contributed to a decision to curtail the mealtime. Similarly, it is plausible that mothers who were previously fussy who may have reduced concerns about food fussiness may have used fewer feeding practices to encourage consumption. In Studies 1 and 4, mothers' food fussiness status may also have influenced their responses on the food fussiness questionnaire. Mothers who were fussy eaters in childhood but enjoy a varied diet as adults may have a decreased perception of food fussiness and might under-report food fussiness in their children resulting in lower scores on the food fussiness subscale. By contrast, mothers who were not fussy eaters as children may view their children's food fussiness as problematic and may therefore have an increased perception of food fussiness and be likely to overestimate their children's food fussiness (e.g., Boquin, Moskowitz, Donovan & Lee, 2014).

Given these considerations, areas of interest for future research include the role of maternal food fussiness on mother's perception of children's food fussiness and their feeding practices. Research could highlight differences in the perception of child food fussiness and the feeding practices used by mothers who are currently fussy eaters, mothers who were previously fussy eaters and mothers who have never been fussy eaters.

6.3.2 Consideration of food fussiness in more diverse samples

Opportunity sampling was employed to recruit families across the studies included in this thesis. Although attempts were made to include a diverse sample representative of the UK by recruiting mothers from a range of sources (i.e. via social media (facebook, netmums, University of Reading Child Development Group Database, Sure-Start centres, mother and toddler groups in Reading and Surrey), these samples are opportunistic and subject to self-selection bias, consequently certain groups were less likely to be represented. Therefore, the findings from these studies cannot be generalised to groups of families that were under-represented. Families that participated in the mother-child dyads in studies 2 and 3 were local to Reading because of the necessity for a home visit. Similarly, because Study 4 was conducted at the University of Reading Infant Lab, geographical proximity was required, consequently, families who took part in Study 4 were generally local to Reading. Findings from these studies are therefore limited to one geographical area of the UK and cannot be generalised beyond this region.

The studies described in this thesis focused on mothers (discussed in Chapter one, pp. 46-47), which means the findings cannot be generalised to fathers. Paternal characteristics might influence food fussiness differently from maternal characteristics, and they may interact. It is recommended that future studies explore the role of paternal factors in child food fussiness.

The samples were also limited because the ability to read and write in English was an inclusion criterion for participation in all the studies conducted, and the ability for mother-child dyads to speak English was an inclusion criterion for Studies 2 and 3 (video-recordings were subsequently coded). These criteria were imposed because there was no resource to translate questionnaires or use interpreters. It is acknowledged that a consequence of these criteria may have been the exclusion of families from diverse ethnic backgrounds. Similarly, it is acknowledged that in all the studies conducted, White, British and well-educated mothers from two-parent households were over-represented and the findings cannot, therefore, be generalised to other ethnic and socioeconomic groups as there is evidence to believe there may be differences. For example, a few studies have found a wide variability in family mealtimes across socioeconomic status (e.g., Horodynski, Brophy-Herb, Henry, Smith, & Weatherspoon, 2009; Neumark-Sztainer, Hannan, Story, Croll, & Perry, 2003). Family meal times are structured and regularly scheduled routines that require advanced planning (Larson, Branscomb, & Wiley, 2006). Family mealtimes bring children and parents closer together and promote positive family mealtime interactions (Jarrett, Bahar, & Kersh, 2014) and are associated with improved dietary quality characterised by increased fruit and vegetable intake and reduced soft drink consumption (e.g., Gillman et al., 2000; Welsh, French, & Wall, 2011). Neumark-Sztainer et al. (2003) found a positive association between family meals and SES, children from higher SES families reported having more family meals. Similarly, mothers of young children with lower incomes reported not having enough time to eat meals with their children as they described being preoccupied with housework during mealtimes (Koulouglioti, Cole, & Moskow, 2011). In both studies, families reported a reliance on snack and convenience foods to feed their families. Horodynski et al. (2009) found that single Black, White and Hispanic mothers of pre-schoolers spent less time eating with their children during mealtimes. These single mothers reported feelings of exhaustion, not having enough time and multitasking during mealtimes as barriers to regular family mealtimes, these mothers also reported providing fast and convenient foods for their families. Given these findings, it is reasonable to assume that mother-child dyads from lower socioeconomic and single household demographic groups might differ from the families sampled in the studies within this thesis. Children from these demographic groups might be accustomed to eating alone and might react uncharacteristically during mother-child interactions in observational studies. Mothers who do not eat with their children may not be accustomed to using controlling feeding practices during mealtimes to encourage food consumption. Because mothers from these demographic groups do not have frequent family mealtimes, it is plausible to assume that they might not be aware of their children's food fussiness as they may not be present to observe behaviours typical of food fussiness. In addition, it has been found that these mothers tend to provide their children with fast foods which has been shown to appeal to most fussy eaters (Tharner et al., 2014) preventing opportunities to observe their children's responses to novel or disliked foods. Consequently, these mothers may have a decreased perception of food fussiness on parent-report questionnaires and may not be in a strong position to provide accurate accounts of children's food fussiness in the parent-report validation study. Given this, a consideration of single parent households and lower income families in future research on this topic is recommended.

Future research would also benefit from focusing on cultures where families generally eat in large groups or share food. While eating from separate plates is the norm in Western cultures, eating in large groups and food sharing is common in certain cultures (Ma, 2015). For example, a grouped dining system is used in Chinese cultures where groups comprising of parents, children and extended family share foods from the same bowl (e.g., Ma, 2015). Eating together in large groups could provide ample opportunities for children to model the eating behaviours of others. As previously discussed in Chapter one (pp. 64-65), modelling has been found to be effective in increasing acceptance of unfamiliar foods in fussy eaters (e.g., Addessi, Galloway, Visalberghi, & Birch, 2005; Harper & Karen, 1975), therefore eating in large groups could be beneficial for fussy eaters. However, in such dynamics, it is possible parents may have limited awareness of children's food consumption since foods are shared making it difficult to ascertain if their child is a fussy eater. Therefore, it would be interesting to evaluate parent's perception of child food fussiness in this group.

6.3.3 The need for longitudinal research

An overarching limitation of the studies conducted is that all are of cross-sectional design, and therefore conclusions about potential causal relationships cannot be inferred (cross-sectional research designs do not allow temporal precedence to be established). Therefore, further research utilizing longitudinal designs is required to establish patterns of causality. Study 1 found higher emotional child temperament to be the strongest predictor of food fussiness in children aged 2-4 years when it was included in a regression analyses with other previously identified significant correlates of food fussiness. However, conclusions about potential causal relationships between emotionality and food fussiness cannot be made and a longitudinal study investigating whether higher emotionality prospectively predicts food fussiness is necessary. For example, a one-year prospective study could investigate whether emotional temperament at age 2 years (Time Point 1) predicts food fussiness at age 3 year (Time Point 2). Regression analyses controlling for baseline food fussiness could then be used to explore longitudinal relationships between emotionality at age 2 years and food fussiness at age 3 years. Although findings from Study 3 is consistent with the possibility that children's highly emotional temperament may cause mothers to use controlling feeding practices culminating in food fussiness, the cross-sectional design of the study did not permit this hypothesis to be tested. A three-wave longitudinal study could examine relationships between maternal use of controlling feeding practices, emotional child temperament and child food fussiness at three time points over a period of time, for instance, over two years. Emotional child temperament could be measured at age

2 years (Time point 1), maternal use of controlling feeding practices could be measured at age 3 years (Time point 2) and child food fussiness measured at age 4 years (Time point 3). Structural equation modelling could then be used to test whether higher emotional child temperament at TP1 predicts maternal use of controlling feeding practices at TP2 which in turn later predicts child food fussiness at TP3. Findings from such longitudinal research would be important as they would confirm whether emotional temperament plays a contributory role to the development of food fussiness directly as indicated by Study 1 or via maternal use of controlling feeding practices as indicated by Study 3. This information would enable early preventive interventions to be directed at children with higher emotional temperaments, with the aim of preventing the development of food fussiness.

6.4 Conclusion

This thesis supports the use of parent-report of food fussiness and provides evidence of cross-sectional relationships between a range of child and maternal factors and child food fussiness. Child temperament, maternal psychopathology, maternal core beliefs, sensory hyperreactivity and controlling feeding practices were identified as cross-sectional correlates of food fussiness. Most notably, emotional temperament emerged as the strongest predictor of food fussiness across studies. Maternal use of verbal pressure and physical prompts were found to moderate the relationship between emotional temperament and food fussiness. Further, parent-report of sensory hyperreactivity in tactile, taste and olfactory sensory domains was found to predict food fussiness after accounting for child emotional temperament.

The findings contribute to the identification of child and maternal factors that may be potential risk factors for the development of food fussiness in young children. Health practitioners working to prevent and decrease fussy eating should consider how interventions might target children's emotional temperament and sensory hyperreactivity and mother's use of pressuring feeding strategies. Supporting parents with their feeding strategies is likely to be particularly important for children with higher emotional temperament given findings that excessive use of controlling feeding practices with such children may exacerbate their fussy eating.

6.5 References

Achenbach, T. M. (1991). *Manual for the Child Behaviour Checklist and Revised Child Behaviour Profile.* Burlington, Vermont: University of Vermont, Department of Psychiatry.

Addessi, E., Galloway, A. T., Visalberghi, E., & Birch, L. L. (2005). Specific social influences on the acceptance of novel foods in 2-5-year-old children. *Appetite*, *45*(3), 264–271. https://doi.org/10.1016/j.appet.2005.07.007

Ainsworth, M. D. S., Blehar, M. C., & Waters, E. &Wall, S. (1978). *Patterns of Attachment: A Psychological Study of the Strange Situation*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Ammaniti, M., Lucarelli, L., Cimino, S., D'Olimpio, F., & Chatoor, I. (2010). Maternal psychopathology and child risk factors in infantile anorexia. *International Journal of Eating Disorders*, *43*(3), 233–240. https://doi.org/10.1002/eat.20688

Anliker, J. A., Bartoshuk, L., Ferris, A. M., & Hooks, L. D. (1991). Children's food preferences and genetic sensitivity to the bitter taste of 6-n-propylthiouracil (PROP). *The American Journal of Clinical Nutrition*, *54*(2), 316–320. http://dx.doi.org/10.1093/ajcn/54.2.316

Antoniou, E. E., Roefs, A., Kremers, S. P. J., Jansen, A., Gubbels, J. S., Sleddens, E. F. C., & Thijs, C. (2016). Picky eating and child weight status development: A longitudinal study. *Journal of Human Nutrition and Dietetics*, *29*(3), 298–307. https://doi.org/10.1111/jhn.12322

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment*, *10*(2), 176-181.

Archer, L. A., Rosenbaum, P. L., & Streiner, D. L. (1991). The Children's Eating Behavior Inventory: Reliability and Validity Results1. *Journal of Pediatric Psychology*, *16*(5), 629–642. http://dx.doi.org/10.1093/jpepsy/16.5.629

Aron, N.E. & Aron, A. (1997). Sensory processing sensitivity and its relation to introversion and emotionality. *Journal of Persnality and Social Psychology, 73 (2),* 345-368.

Aron, N.E., Aron, A., & Davies, K.M. (2005). Adult shyness: The interaction of temperamnetal sensitivity and an adverse childhood environment. *Journal of Personality and Social Psychology, 31 (2), 181-197*

Ashcroft, J., Semmler, C., Carnell, S., van Jaarsveld, C. H. M., & Wardle, J. (2008). Continuity and stability of eating behaviour traits in children. *European Journal of Clinical Nutrition*, *62*(8), 985-990. https://doi.org/10.1038/sj.ejcn.1602855

Bakker, I. (1988). "Women's employment in comparative perspective" in Jenson, J., Hagan, E. & Reddy, C (eds) *Feminization of the Labour Force*, pp. 65-84. Cambridge: Polity Press.

Barr, R. G., Pantel, M. S., Young, S. N., Wright, J. H., Hendricks, L. A., & Gravel, R. (1999). The response of crying newborns to sucrose: Is it a "sweetness" effect? *Physiology and Behavior*, *66*(3), 409–417. https://doi.org/10.1016/S0031-9384(98)00294-7

Bates, J. E., Pettit, G. S., Dodge, K. A., & Ridge, B. (1998). Interaction of temperamental resistance to control and restrictive parenting in the development of externalizing behavior. *Developmental Psychology*, *34*(5), 982–995. https://doi.org/10.1037/0012-1649.34.5.982

Bates, J E, Freeland, C. A. B., & Lounsbury, M. L. (1979). Measurement of infant difficultness. *Child Development*, 794–803.

Batsell, W. R., Brown, A. S., Ansfield, M. E., & Paschall, G. Y. (2002). "You will eat all of that!": a retrospective analysis of forced consumption episodes. *Appetite*, *38*(3), 211–219. https://doi.org/10.1006/appe.2001.0482

Baxter, I. A., Jack, F. R., & Schroder, M. J. A. (1998). The use of Repertory Grid method to elicit perceptual data from primary school children. *Food Quality and Preference*, *9*(1/2), 73–80. https://doi.org/10.1016/S0950-3293(97)00031-1

Beauchamp, G. K., & Moran, M. (1982). Dietary experience and sweet taste preference in human infants. *Appetite*, *3*(2), 139–152. https://doi.org/10.1016/S0195-6663(82)80007-X

Beck, C. T. (2001). Predictors of postpartum depression: an update. *Nursing Research*, *50*(5), 275–285.

Bell, K. I. & Tepper, B. J. (2006). *Short-term vegetable intake by young children classified by* 6-n-propylthoiuracil bitter-taste phenotype. *American Journal of Clinical Nutrition, 84, 245-251*

Berger, P. K., Hohman, E. E., Marini, M. E., Savage, J. S., & Birch, L. L. (2016). Girls' picky eating in childhood is associated with normal weight status from ages 5 to 15 years. *American Journal of Clinical Nutrition, 104 (6), 1577-1582*. https://doi.org/10.3945/ajcn.116.1424

Bergmeier, H., Skouteris, H., & Hetherington, M. (2015). Systematic research review of observational approaches used to evaluate mother-child mealtime interactions during preschool years. *American Journal of Clinical Nutrition*, *101*(1), 7–15. https://doi.org/10.3945/ajcn.114.092114

Berlin, K.S., Davies, W.H., Lobato, D.J., & Silverman, A.H., (2009). A Biopsychosocial Model of Normative and Problematic Paediatric Feeding. *Children's Health Care, 38, 263-282.*

Berry, W. D. (1993). *Understanding regression assumptions* . Newbury Park, CA: Sage Publications.

Birch, L L, Fisher, J. O., Grimm-Thomas, K., Markey, C. N., Sawyer, R., & Johnson, S. L. (2001). Confirmatory factor analysis of the Child Feeding Questionnaire: a measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite*, *36*(3), 201–210. https://doi.org/10.1006/appe.2001.0398

Birch, L. L., & Marlin, D. W. (1982). I don't like it; I never tried it: Effects of exposure on two-year-old children's food preferences. *Appetite*, *3*(4), 353–360. https://doi.org/10.1016/S0195-6663(82)80053-6

Birch, L. L., & Fisher, J. O. (2000). Mothers' child-feeding practices influence daughters' eating and weight. *American Journal of Clinical Nutrition*, *71*(5), 1054–1061. https://doi.org/10.1016/j.biotechadv.2011.08.021.Secreted

Birch, L. L., Fisher, J. O., & Davison, K. K. (2003). Learning to overeat: Maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *American Journal of Clinical Nutrition*, *78*(2), 215–220. https://doi.org/10.1038/nrm2621

Birch, L. L., Gunder, L., Grimm-Thomas, K., & Laing, D. G. (1998). Infants' consumption of a new food enhances acceptance of similar foods. *Appetite*, *30*(3), 283–295. https://doi.org/10.1006/appe.1997.0146

Birch, L. L. (1998). Development of food acceptance patterns in the first years of life. *Proceedings of the Nutrition Society*, *57*(4), 617–624.

Birch, L. L. (1999). Development of Food Preferences. *Annu. Rev. Nutr*, *19*, 41–62. https://doi.org/10.1146/annurev.nutr.19.1.41

Birch, L. L., & Fisher, J. O. (1998). Development of Eating Behaviors Among Children and Adolescents*.* Paediatrics, 101 (2), 539-549

Birch, L. L., & Deysher, M. (1985). Conditioned and unconditioned caloric compensation: evidence for self-regulation of food intake in young children. *Learning and Motivation*, *16*(3), 341–355.

Birch, L. L. , Marlin, D. W., & Rotter, J. (1984). Eating as the "Means" Activity in a Contingency: Effects on Young Children's Food Preference. *Child Development*, *55*(2), 431–439. https://doi.org/10.2307/1129954

Birch, L. L. , McPhee, L., Shoba, B. C., Pirok, E., & Steinberg, L. (1987). What kind of exposure reduces children's food neophobia?: Looking vs. tasting. *Appetite*, *9*(3), 171–178. https://doi.org/10.1016/S0195-6663(87)80011-9

Birch, L. L. , Zimmerman, S. I., & Hind, H. (1980). The Influence of Social-Affective Context on the Formation of Children's Food Preferences. *Child Development*, *51*(3), 856–861. https://doi.org/10.2307/1129474

Blascovich, J., & Tomaka, J. (1991). Measures of self-esteem. *Measures of Personality and Social Psychological Attitudes*, *1*, 115–160.

Blissett, J., Meyer, C., & Haycraft, E. (2007). Maternal mental health and child feeding problems in a non-clinical group. *Eating Behaviors, 8, 311-318*. https://doi.org/10.1016/j.eatbeh.2006.11.007

Blissett, J. (2011). Relationships between parenting style, feeding style and feeding practices and fruit and vegetable consumption in early childhood. *Appetite*, *57*(3), 826–831. https://doi.org/10.1016/j.appet.2011.05.318

Blissett, J., & Fogel, A. (2013). Intrinsic and extrinsic influences on children's acceptance of new foods. *Physiology and Behavior*, *121*, 89–95. https://doi.org/10.1016/j.physbeh.2013.02.013

Blissett, J., & Haycraft, E. (2011). Parental eating disorder symptoms and observations of mealtime interactions with children. *Journal of Psychosomatic Research*, *70*(4), 368–371. https://doi.org/10.1016/j.jpsychores.2010.07.006

Blissett, J., Meyer, C., Farrow, C., Bryant-Waugh, R., & Nicholls, D. (2005). Maternal core beliefs and children's feeding problems. *International Journal of Eating Disorders*, *37*(2), 127–134. https://doi.org/10.1002/eat.20070

Blissett, J., Bennett, C., Donohoe, J., Rogers, S., & Higgs, S. (2012). Predicting Successful Introduction of Novel Fruit to Preschool Children. *Journal of the Academy of Nutrition and Dietetics*, *112*(12), 1959–1967.

https://doi.org/10.1016/j.jand.2012.08.014
Blissett, J., Meyer, C., & Haycraft, E. (2006). Maternal and paternal controlling feeding practices with male and female children. *Appetite*, *47*(2), 212–219. https://doi.org/10.1016/j.appet.2006.04.002
Blossfeld, I., Collins, A., Kiely, M., & Delahunty, C. (2007). Texture preferences of 12-month-old infants and the role of early experiences. *Food Quality and Preference*, *18*(2), 396–404. https://doi.org/10.1016/j.foodqual.2006.03.022
Boer, F., & Westenberg, P. M. (1994). The factor structure of the Buss and Plomin EAS Temperature Survey (parental ratings) in a Dutch sample of elementary school children. *Journal of Personality Assessment*, *62*(3), 537–551.
Boffetta, P., Couto, E., Wichmann, J., Ferrari, P., Trichopoulos, D., Bueno-De-Mesquita, H. B., … Trichopoulou, A. (2010). Fruit and vegetable intake and overall cancer risk in the european prospective investigation into cancer and nutrition (EPIC). *Journal of the National Cancer Institute*, *102*(8), 529–537. https://doi.org/10.1093/jnci/djq072
Boquin, M. M., Moskowitz, H. R., Donovan, S. M., & Lee, S. Y. (2014). Defining perceptions of picky eating obtained through focus groups and conjoint analysis. *Journal of Sensory Studies, 29, 126-138*. https://doi.org/10.1111/joss.12088
Boquin, M., Smith-Simpson, S., Donovan, S. M., & Lee, S. Y. (2014). Mealtime Behaviors and Food Consumption of Perceived Picky and Nonpicky Eaters through Home Use Test. *Journal of Food Science*, *79*(12), S2523-S2532. https://doi.org/10.1111/1750-3841.12698
Bowerman, B. L., & O'Connell, R. T. (1990). *Linear statistical models: An applied approach, 2nd ed., Duxbury, Belmont, CA*.
Brandon, S. (1970). An epidemiological study of eating disturbances. *Journal of Psycho-somatic Research, 14, 253–257.*
Brann, L.S. & Skinner, J.D. (2005). More controlling child feeding practices are found among parents of boys with an average body mass index compared with parents of boys with a high body mass index. *Journal of the American Dietetic Association, 105 (9), 1411-1416.*
Brayfield, A. A. (1992). Employment resources and housework in Canada. *Journal of Marriage and the Family*, 54, 19–30.
Brody, G. H., & Stoneman, Z. (2018). Selective Imitation of Same-Age, Older and Younger Peer Models. *Child Development, 52, 717-720. http://www.jstor.org/stable/1129197 REFERENCES*. *52*(2), 717–720.
Brown, B. J., & Hermann, J. R. (2005). Cooking Classes Increase Fruit and Vegetable Intake and Food Safety Behaviors in Youth and Adults. *Journal of Nutrition Education and Behavior*, *37*(2), 104–105. https://doi.org/10.1016/S1499-4046(06)60027-4
Brown, C. L., Perrin, E. M., Peterson, K. E., Herb, H. E. B., Horodynski, M. A., Contreras, D., … Lumeng, J. C. (2018). Association of picky eating with weight status and dietary quality among low-income preschoolers. *Academic Pediatrics*, *18*(3), 334–341.
Brown, R., & Ogden, J. (2004). Children's eating attitudes and behaviour: A study of the modelling and control theories of parental influence. *Health Education*

Research, *19*(3), 261–271. https://doi.org/10.1093/her/cyg040
Brown, T. A., Chorpita, B. F., Korotitsch, W., & Barlow, D. H. (1997). Psychometric properties of the Depression Anxiety Stress Scales (DASS) in clinical samples. *Behaviour Research and Therapy*, *35*(1), 79–89.
Browne, J. V. (2008). Chemosensory Development in the Fetus and Newborn. *Newborn and Infant Nursing Reviews*, *8*(4), 180–186. https://doi.org/10.1053/j.nainr.2008.10.009
Brug, J., Tak, N. I., te Velde, S. J., Bere, E., & De Bourdeaudhuij, I. (2008). Taste preferences, liking and other factors related to fruit and vegetable intakes among schoolchildren: results from observational studies. *British Journal of Nutrition*, *99*(S1), S7–S14.
Burt, J.V. & Hertzler, A.A. (1978). Parental influence on the child's food preference. *Journal of Nutrition Education, 10 (3), 127-128*
Buss, A. H., & Plomin, R. (1984). Theory and measurement of EAS. *Temperament: Early Developing Personality Traits*, 98–130.
Buss, H., & Plomin, R. (1975). A temperament theory of personality development. In *A temperament theory of personality development.* Oxford, England: Wiley-Interscience.
Byrne, R., Jansen, E., & Daniels, L. (2016). Perceived fussy eating in children at 14 months of age and subsequent use of maternal feeding practices at 2 years. *International Journal of Behavioural Nutrition and Physical Activity, 14, 123-132.* https://doi.org/10.1186/s12966-017-0582-z
Cabanac, M. (1985). Preferring for pleasure. *American Journal of Clinical Nutrition*, *42*(5 SUPPL.), 1151–1155. https://doi.org/10.1093/ajcn/42.5.1151
Cameron, J. (2001). Negative Effects of Reward on Intrinsic Motivation—A Limited Phenomenon: Comment on Deci, Koestner, and Ryan (2001). *Review of Educational Research*, *71*(1), 29–42. https://doi.org/10.3102/00346543071001029
Campbell, K. J., Crawford, D. A., & Ball, K. (2006). Family food environment and dietary behaviors likely to promote fatness in 5-6 year-old children. *International Journal of Obesity*, *30*(8), 1272–1280. https://doi.org/10.1038/sj.ijo.0803266
Cao, Y.-T., Svensson, V., Marcus, C., Zhang, J., Zhang, J.-D., & Sobko, T. (2012). Eating behaviour patterns in Chinese children aged 12-18 months and association with relative weight-factorial validation of the Children's Eating Behaviour Questionnaire. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 5.
Capsi, A., & Shiner, R. L. (2006). Personality development. *Handbook of Child Psychology, Sixth Edition. Wiley & Sons*, 300.
Cardel, M., Willig, A. L., Dulin-Keita, A., Casazza, K., Beasley, T. M., & Fernández, J. R. (2012). Parental feeding practices and socioeconomic status are associated with child adiposity in a multi-ethnic sample of children. *Appetite*, *58*(1), 347–353.
Cardona Cano, S., Hoek, H. W., van Hoeken, D., de Barse, L. M., Jaddoe, V. W. V., Verhulst, F. C., & Tiemeier, H. (2016). Behavioral outcomes of picky eating in childhood: a prospective study in the general population. *Journal of Child Psychology and Psychiatry*, 57 (11), 1239-1246.

https://doi.org/10.1111/jcpp.12530
Cardona Cano, S., Tiemeier, H., Van Hoeken, D., Tharner, A., Jaddoe, V. W. V, Hofman, A., … Hoek, H. W. (2015). Trajectories of picky eating during childhood: a general population study. *International Journal of Eating Disorders*, *48*(6), 570–579.
Carnell, S., Cooke, L., Cheng, R., Robbins, A., & Wardle, J. (2011). Parental feeding behaviours and motivations. A qualitative study in mothers of UK pre-schoolers. *Appetite*, *57*(3), 665–673. https://doi.org/10.1016/j.appet.2011.08.009
Carnell, S.,, & Wardle, J. (2007). Measuring behavioural susceptibility to obesity: Validation of the child eating behaviour questionnaire. *Appetite*, *48*(1), 104–113. https://doi.org/10.1016/j.appet.2006.07.075
Carper, J. L., Orlet Fisher, J., & Birch, L. L. (2000). Young girls' emerging dietary restraint and disinhibition are related to parental control in child feeding. *Appetite*, *35*(2), 121–129. https://doi.org/10.1006/appe.2000.0343
Carruth, B. R., & Skinner, J. D. (2013). Revisiting the picky eater phenomenon: neophobic behaviors of young children. *Journal of the American College of Nutrition*, *19*(6), 771–780. https://doi.org/10.1080/07315724.2000.10718077
Carruth, B R, Skinner, J., Houck, K., Moran, J., Coletta, F., & Ott, D. (1998). The phenomenon of "picky eater": a behavioral marker in eating patterns of toddlers. *Journal of the American College of Nutrition, 17 (2), 180-186*. https://doi.org/10.1080/07315724.1998.10718744
Carruth, B. R., & Skinner, J. D. (2000). Revisiting the Picky Eater Phenomenon: Neophobic Behaviors of Young Children. *Journal of the American College of Nutrition*, *19*(6), 771–780. https://doi.org/10.1080/07315724.2000.10718077
Carruth, B., R.,, Ziegler, P. J., Gordon, A., & Barr, S. I. (2004). Prevalence of picky eaters among infants and toddlers and their caregivers' decisions about offering a new food. *Journal of the American Dietetic Association*, *104*(SUPPL. 1), 57–64. https://doi.org/10.1016/j.jada.2003.10.024
Cascio, C., McGlone, F., Folger, S., Tannan, V., Baranek, G., Pelphrey, K. A., & Essick, G. (2008). Tactile Perception in Adults with Autism: a Multidimensional Psychophysical Study. *Journal of Autism and Developmental Disorders*, *38*(1), 127–137. https://doi.org/10.1007/s10803-007-0370-8
Cassells, E. L., Magarey, A. M., Daniels, L. a., & Mallan, K. M. (2014). The influence of maternal infant feeding practices and beliefs on the expression of food neophobia in toddlers. *Appetite*, *82*, 36–42. https://doi.org/10.1016/j.appet.2014.07.001
Cathey, M., & Gaylord, N. (2004). Picky eating: a toddler's continuing approach to mealtime. *Pediatric Nursing*, *30*(2), 101–107. http://www.ncbi.nlm.nih.gov/pubmed/15185731
Centres for Disease Control and Prevention. National Centre for Health Statistics. *Clinical Growth Charts.* Published May 30, 2000. Updated October 15, 2008. http:// www.cdc.gov/nchs/about/major/nhanes/growthcharts/ clinical_charts.htm. (accessed 13/05/17).
Champagne, F. A., & Mashoodh, R. (2009). Genes in context. *Current Directions in Psychological Science*, *18*(3), 127–132. https://doi.org/10.1111/j.1467-8721.2009.01622.x

Chatoor, I., Hirsch, R., Ganiban, J., Persinger, M., & Hamburger, E. (1998). Diagnosing Infantile Anorexia: The Observation of Mother-Infant Interactions. *Journal of the American Academy of Child & Adolescent Psychiatry*, *37*(9), 959–967. https://doi.org/10.1097/00004583-199809000-00016

Chatoor, I, Ganiban, J., Hirsch, R., Borman-Spurrell, E., & Mrazek, D. a. (2000). Maternal characteristics and toddler temperament in infantile anorexia. *Journal of the American Academy of Child and Adolescent Psychiatry*, *39*(6), 743–751. https://doi.org/10.1097/00004583-200006000-00013

Chatoor, I.,, Egan, J., Getson, P., Menvielle, E., & O'Donnell, R. (1988). Mother—infant interactions in infantile anorexia nervosa. *Journal of the American Academy of Child & Adolescent Psychiatry*, *27*(5), 535–540.

Chatoor, I.,, Surles, J., Ganiban, J., Beker, L., & Paez, L. M. (2004). Failure to Thrive and Cognitive Development in Toddlers With Infantile Anorexia. P*aediatrics, 113(5), 440-447.*. https://doi.org/10.1542/peds.113.5.e440

Clara, I. P., Cox, B. J., & Enns, M. W. (2001). Confirmatory factor analysis of the Depression–Anxiety–Stress Scales in depressed and anxious patients. *Journal of Psychopathology and Behavioral Assessment*, *23*(1), 61–67.

Clark, H. R., Goyder, E., Bissell, P., Blank, L., & Peters, J. (2007). How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy. *Journal of Public Health*, *29*(2), 132–141. https://doi.org/10.1093/pubmed/fdm012

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-159.

Cooke, L J, Wardle, J., Gibson, E., Sapochnik, M., Sheiham, A., & Lawson, M. (2004). Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children. *Public Health Nutrition*, *7(02), 295–302*. https://doi.org/10.1079/PHN2003527

Cooke, L. J., Chambers, L. C., Añez, E. V., & Wardle, J. (2011). Facilitating or undermining? The effect of reward on food acceptance. A narrative review. *Appetite*, *57*(2), 493–497. https://doi.org/10.1016/j.appet.2011.06.016

Cooper, M., Cohen-Tovée, E., Todd, G., Wells, A., & Tovée, M. (1997). The eating disorder belief questionnaire: Preliminary development. *Behaviour Research and Therapy*, *35*(4), 381–388. https://doi.org/10.1016/S0005-7967(96)00115-5

Cooper, P. J., Whelan, E., Woolgar, M., Morrell, J., & Murray, L. (2004). Association between childhood feeding problems and maternal eating disorder: Role of the family environment. *British Journal of Psychiatry*, *184*, 210–215. https://doi.org/10.1192/bjp.184.3.210

Corsini, N., Danthiir, V., Kettler, L., & Wilson, C. (2008). Factor structure and psychometric properties of the Child Feeding Questionnaire in Australian preschool children. *Appetite*, *51*(3), 474–481.

Coulthard, H., & Harris, G. (2003). Early food refusal: The role of maternal mood. *Journal of Reproductive and Infant Psychology, 21, 335-345*. https://doi.org/10.1080/02646830310001622097

Coulthard, H., & Blissett, J. (2009). Fruit and vegetable consumption in children and their mothers. Moderating effects of child sensory sensitivity. *Appetite*, *52*(2),

410–415. https://doi.org/10.1016/j.appet.2008.11.015
Coulthard, H., Harris, G., & Emmett, P. (2009). Delayed introduction of lumpy foods to children during the complementary feeding period affects child's food acceptance and feeding at 7 years of age. *Maternal and Child Nutrition*, *5*(1), 75–85. https://doi.org/10.1111/j.1740-8709.2008.00153.x
Coulthard, H., Palfreyman, Z., & Morizet, D. (2016). Sensory evaluation of a novel vegetable in school age children. *Appetite*, *100*, 64–69. https://doi.org/10.1002/ppsc.19850020129
Craig, L. (2006). Does father care mean fathers share?: A comparison of how mothers and fathers in intact families spend time with children. *Gender and Society*, *20*(2), 259–281. https://doi.org/10.1177/0891243205285212
Crawford, J. R., & Henry, J. D. (2003). The Depression Anxiety Stress Scales (DASS): normative data and latent structure in a large non-clinical sample. *The British Journal of Clinical Psychology / the British Psychological Society*, *42*(Pt 2), 111–131. https://doi.org/10.1348/014466503321903544
Cullen, K. W., Baranowski, T., Rittenberry, L., Cosart, C., Hebert, D., & de Moor, C. (2001). Child-reported family and peer influences on fruit, juice and vegetable consumption: reliability and validity of measures. *Health Education Research*, *16*(2), 187–200. https://doi.org/10.1093/her/16.2.187
Cutting, T. M., Fisher, J. O., Grimm-Thomas, K., & Birch, L. L. (1999). Like mother, like daughter: Familial patterns of overweight are mediated by mothers' dietary disinhibition. *American Journal of Clinical Nutrition*, *69*(4), 608–613. https://doi.org/10.1097/00004583-199910000-00028
de Barse, L. M., Cano, S. C., Jansen, P. W., Jaddoe, V. V. W., Verhulst, F. C., Franco, O. H., … Tharner, A. (2016). Are parents' anxiety and depression related to child fussy eating? *Archives of Disease in C*hildhood *101*(6*), 533-538.* https://doi.org/10.1136/archdischild-2015-309101
De Droog, S. M., Buijzen, M., & Valkenburg, P. M. (2014). Enhancing children's vegetable consumption using vegetable-promoting picture books. The impact of interactive shared reading and character-product congruence. *Appetite*, *73*, 73–80. https://doi.org/10.1016/j.appet.2013.10.018
DEFRA. (2010 August). *Report of the fruit and vegetables task force:* http://www.defra.gov.uk/foodfarm/food/policy/partnership/fvtf/index.htm
Dellava, J. E., Trace, S. E., Strober, M., Thornton, L. M., Klump, K. L., Brandt, H., … Berrettini, W. H. (2013). *NIH Public Access*. *20*(2), 111–115. https://doi.org/10.1002/erv.1153.Retrospective
Demir, D., Skouteris, H., Dell'Aquila, D., Aksan, N., McCabe, M. P., Ricciardelli, L. A., … Baur, L. A. (2012). An observational approach to testing bi-directional parent-child interactions as influential to child eating and weight. *Early Child Development and Care*, *182*(8), 943–950. https://doi.org/10.1080/03004430.2012.678591
Dempster, A. P., Laird, N. M., & Rubin, D. B. (1977). Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society. Series B*, 39, 1–38.

Denham, S.A., Zahn- Waxler, C., Cummings, E.M., & Iannotti, R.J. (1991). Social competence in young children's peer relations: Patterns of developmental change. *Child Psychiatry and Human Development, 22 (1), 29-44.*

Denham, S.A. & Burton, R. (1996). A socio-emotional intervention for at- risk 4-year olds. *Journal of School Psychology, 34 (3), 225-245.*

Dobrenski, R. A. (2001). Romantic jealousy: Symptoms, schemas, and attachment. *Dissertation Abstracts International, 62*(6-B), 2954.

Dodd, H.F., Ryan, Z., & Rayson, H. (2017, November*).* Anxiety and attention in preschool aged children. In H. Dodd (chair), Advances in Child Anxiety. Symposium conducted at the International Congress of Clinical and Health Psychology on Children and Adolescence, Seville, Spain.

Dohadwala, M. M., & Vita, J. a. (2009). Grapes and Cardiovascular Disease 1 – 3. *Clinical Research*, *139*(9), 1788S–1793S. https://doi.org/10.3945/jn.109.107474.1788S

Domoff, S. E., Miller, A. L., Kaciroti, N., & Lumeng, J. C. (2015). Validation of the Children's Eating Behaviour Questionnaire in a low-income preschool-aged sample in the United States. *Appetite*, *95*, 415–420. https://doi.org/10.1016/j.appet.2015.08.002

Dovey, T. M., Staples, P. A., Gibson, E. L., & Halford, J. C. G. (2008). Food neophobia and "picky/fussy" eating in children: A review. *Appetite, 50, 181-193*. https://doi.org/10.1016/j.appet.2007.09.009

Drewnowski, A., Henderson, S. A., & Barratt-Fornell, A. (2001). *Genetic Taste Markers and Food Preferences*. *29*(4), 535–538. http://dmd.aspetjournals.org

Dubois, L., Farmer, a P., Girard, M., & Peterson, K. (2007). Preschool children's eating behaviours are related to dietary adequacy and body weight. *European Journal of Clinical Nutrition*, *61*(7), 846–855. https://doi.org/10.1038/sj.ejcn.1602586

Duffy, V. B., & Bartoshuk, L. M. (2000). Food acceptance and genetic variation in taste. *Journal of the American Dietetic Association*, Vol. 100, pp. 647–655. https://doi.org/10.1016/S0002-8223(00)00191-7

Duncan, J.S., Duncan, E.K., & Schofield, G. (2009). Accuracy of Body Mass Index (BMI) thresholds for predicting excess body fat in girls from five ethnicities. *Asia Pacific Journal of Nutrition, 18 (3), 404-411.*

Duncker, K. (1938). Experimental modification of children's food preferences through social suggestion. *The Journal of Abnormal and Social Psychology*, *33*(4), 489–507. https://doi.org/10.1037/h0056660

Dunn, W. (1997). The Impact of Sensory Processing Abilities on the Daily Lives of Young Children and Their Families: A Conceptual Model. *Inf Young Children*, *9*(4), 23–35. https://doi.org/10.1097/00001163-199704000-00005

Dunn, W. (1999). *Sensory profile: User's manual*. Psychological Corporation San Antonio, TX: Psychological Corporation.

Eberhardt, M. V, Lee, C. Y., & Liu, R. H. (2000). Antioxidant activity of fresh apples. *Nature*, *405*, 903-904. http://dx.doi.org/10.1038/35016151

Echambadi, R. & Hess, J.D. (2007). Mean centering does not alleviate collinearity problems in moderated multiple regression models. *Marketing Science, 26 (3), 438-445.*

Eddy, K. T., Thomas, J. J., Hastings, E., Edkins, K., Lamont, E., Nevins, C. M., … Becker, A. E. (2015). Prevalence of DSM-5 avoidant/restrictive food intake disorder in a pediatric gastroenterology healthcare network. *International Journal of Eating Disorders*, *48*(5), 464–470.

Efron, B. & Tibshirani, R. (1986). Bootstrap Methods for Standard Errors, Confidence Intervals, and Other Measures of Statistical Accuracy. *Statistical Science, 1, 54-75.* : *https://www.jstor.org/stable/2245500*

Ekstein, S., Laniado, D., & Glick, B. (2010). Does picky eating affect weight-for-length measurements in young children? *Clinical Pediatrics*, *49*(3), 217–220. https://doi.org/10.1177/0009922809337331

Ellis, J. M., Galloway, A. T., Webb, R. M., Martz, D. M., & Farrow, C. V. (2016). Recollections of pressure to eat during childhood, but not picky eating, predict young adult eating behavior. *Appetite*, *97*, 58–63. https://doi.org/10.1016/j.appet.2015.11.020

Emmett, P. M., Hays, N. P., & Taylor, C. M. (2018). Antecedents of picky eating behaviour in young children. *Appetite*, *130*(July), 163–173. https://doi.org/10.1016/j.appet.2018.07.032

Engel, G. L., (1977). The need for a new medical model: A challenge for biomedicine. *Science. 196(4286):129–36.*

EUFIC. (2010). *Encouraging young children to eat different vegetables*: [http://www.eufic. orgarticle/en/page/FTARCHIVE/artid/Encouraging-young-children-eat-different- vegetables/.](http://www.eufic.orgarticle/en/page/FTARCHIVE/artid/Encouraging-young-children-eat-different-vegetables/)

Faith, M. S., Scanlon, K. S., Birch, L. L., Francis, L. a, & Sherry, B. (2004). Parent-child feeding strategies and their relationships to child eating and weight status. *Obesity Research*, *12*(11), 1711–1722. https://doi.org/10.1038/oby.2004.212

Farrow, C. V., & Blissett, J. (2008). Controlling Feeding Practices: Cause or Consequence of Early Child Weight? *Pediatrics*, *121*(1), e164 LP-e169. Retrieved from http://pediatrics.aappublications.org/content/121/1/e164.abstract

Farrow, C.V., & Blissett, J. (2006). Maternal cognitions, psychopathologic symptoms, and infant temperament as predictors of early infant feeding problems: a longitudinal study. *International Journal of Eating Disorders*, *39*(2), 128–134.

Farrow, C.V., Blissett, J. M., & Haycraft, E. L. (2011). Does child weight influence how mothers report their feeding practices? *International Journal of Pediatric Obesity, 6 (3,4), 306-313.*

Farrow, C. V., & Coulthard, H. (2012). Relationships between sensory sensitivity, anxiety and selective eating in children. *Appetite*, *58*(3), 842–846. https://doi.org/10.1016/j.appet.2012.01.017

Farrow, C. V., Galloway, A. T., & Fraser, K. (2009). Sibling eating behaviours and differential child feeding practices reported by parents. *Appetite*, *52*(2), 307–312.

Faul, F., ErdFelder, E., Lang, a.-G., & Buchner, a. (2007). A Flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavioral Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Fernandez, C., DeJesus, J. M., Miller, A. L., Appugliese, D. P., Rosenblum, K. L., Lumeng, J. C., & Pesch, M. H. (2018). Selective eating behaviors in children: An observational validation of parental report measures. *Appetite*, *127*, 163–170. https://doi.org/10.1016/j.appet.2018.04.028

Feunekes, I. J., Van Staveren, W. A., Graveland, F., Vos, J. De, & Burema, J. (1995). Reproducibility of a semiquantitative food frequency questionnaire to assess the intake of fats and cholesterol in The Netherlands. *International Journal of Food Sciences and Nutrition*, *46*(2), 117–123.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage.

Finistrella, V., Manco, M., Ferrara, A., Rustico, C., Presaghi, F., & Morino, G. (2012). Cross-Sectional Exploration of Maternal Reports of Food Neophobia and Pickiness in Preschooler-Mother Dyads. *Journal of the American College of Nutrition*, *31*(3), 152–159. https://doi.org/10.1080/07315724.2012.10720022

Fisher, J. O., & Birch, L. L. (1999). Restricting access to palatable foods affects children ' s behavioral response, food selection, and intake. *American Journal of Clincal Nutrition, 69, 1264–1272.*

Fisher, J. O., Mitchell, D. C., Smiciklas-Wright, H., & Birch, L. L. (2002). Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *Journal of the American Dietetic Association*, *102*(1), 58–64. https://doi.org/10.1016/S0002-8223(02)90017-9

Fisher, M. M., Rosen, D. S., Ornstein, R. M., Mammel, K. A., Katzman, D. K., Rome, E. S., … Walsh, B. T. (2014). Characteristics of avoidant/restrictive food intake disorder in children and adolescents: a "new disorder" in DSM-5. *Journal of Adolescent Health*, *55*(1), 49–52.

Fleming, J. S., & Courtney, B. E. (1984). The dimensionality of self-esteem: II. Hierarchical facet model for revised measurement scales. *Journal of Personality and Social Psychology*, *46*(2), 404.

Forestell, C. a., & Mennella, J. a. (2012). More than just a pretty face. The relationship between infant's temperament, food acceptance, and mothers' perceptions of their enjoyment of food. *Appetite*, *58*(3), 1136–1142. https://doi.org/10.1016/j.appet.2012.03.005

Fowler, G., Fuller, A., Mant, D., & Jones, L. (1989). The" Help Your Patient Stop" initiative: evaluation of smoking prevalence and dissemination of WHO/UICC guidelines in UK general practice. *The Lancet*, *333*(8649), 1253–1255.

Fox, N. A. (1989). Psychophysiological correlates of emotional reactivity during the first year of life. *Developmental Psychology*, *25*(3), 364-372.

Francis, L. A., & Birch, L. L. (2005). Maternal influences on daughters' restrained eating behavior. *Health Psychology*, *24*(6), 548-554.

Franck, E., De Raedt, R., Barbez, C., & Rosseel, Y. (2008). Psychometric properties of the Dutch Rosenberg Self-Esteem Scale. *Psychologica Belgica, 48 (1), 25-35*

Fraser, K., Wallis, M., & John, W. S. (2004). Improving children's problem eating and mealtime behaviours: An evaluative study of a single session parent education programme. *Health Education Journal*, *63*(3), 229–241. https://doi.org/10.1177/001789690406300304

Fries, L. R., Martin, N., & van der Horst, K. (2017). Parent-child mealtime interactions associated with toddlers' refusals of novel and familiar foods. *Physiology and Behavior*, *176*, 93–100. https://doi.org/10.1016/j.physbeh.2017.03.001

Galindo, M. M., Schneider, N. Y., Stähler, F., Töle, J., & Meyerhof, W. (2012). Taste Preferences. *Progress in Molecular Biology and Translational Science*, *108*, 383–426. https://doi.org/10.1016/B978-0-12-398397-8.00015-0

Galloway, A. T., Fiorito, L., Lee, Y., & Birch, L. L. (2005). Parental pressure, dietary patterns, and weight status among girls who are “picky eaters.” *Journal of the American Dietetic Association*, *105*(4), 541–548. https://doi.org/10.1016/j.jada.2005.01.029

Galloway, A. T., Lee, Y., & Birch, L. L. (2003). Predictors and consequences of food neophobia and pickiness in young girls. *Journal of the American Dietetic Association*, *103*(6), 692–698. https://doi.org/10.1053/jada.2003.50134

Ganiban, J. M., Saudino, K. J., Ulbricht, J., Neiderhiser, J. M., & Reiss, D. (2008). Stability and change in temperament during adolescence. *Journal of Personality and Social Psychology*, *95*(1), 222-236.

Geng, G., Zhu, Z., Suzuki, K., Tanaka, T., Ando, D., Sato, M., & Yamagata, Z. (2009). Confirmatory factor analysis of the Child Feeding Questionnaire (CFQ) in Japanese elementary school children. *Appetite*, *52*(1), 8–14.

Gerrish, C. J., & Mennella, J. A. (2001). Flavor variety enhances food acceptance in formula-fed infants. *American Journal of Clinical Nutrition*, *73*(6), 1080–1085. https://doi.org/10.1177/000992280204100311

Gibson, E. L., & Wardle, J. (2003). Energy density predicts preferences for fruit and vegetables in 4-year-old children. *Appetite*, *41*(1), 97–98. https://doi.org/10.1016/S0195-6663(03)00077-1

Gibson, E. L., Wardle, J., & Watts, C. J. (1998). Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite*, *31*(2), 205–228. https://doi.org/10.1006/appe.1998.0180

Gillman, M. W., Rifas-Shiman, S. L., Frazier, A. L., Rockett, H. R. H., Camargo Jr, C. A., Field, A. E., … Colditz, G. A. (2000). Family dinner and diet quality among older children and adolescents. *Archives of Family Medicine*, *9*(3), 235.

Glackin, L. M., Fraser, M., & O Neill, M. B. (2008). The adequacy of dietary fibre intake in 5-8 year old children. *Irish Medical Journal*, *101*(4), 118—120. http://europepmc.org/abstract/MED/18557515

Goh, D. Y., & Jacob, A. (2012). Perception of picky eating among children in Singapore and its impact on caregivers: a questionnaire survey. *Asia Pacific Family Medicine*, *11*(1), 5. https://doi.org/10.1186/1447-056X-11-5

Goldsmith, H. H., Buss, A. H., Plomin, R., Rothbart, M. K., Thomas, A., Chess, S., … McCall, R. B. (1987). Roundtable: What is temperament? Four approaches. *Child Development*, 505–529.

Goldsmith, H. H., & Campos, J. J. (1986). Fundamental issues in the study of early temperament: The Denver Twin Temperament Study. *Advances in Developmental Psychology*, *4*, 231–283.

Goodyer, I. M., Ashby, L., Altham, P. M. E., Vize, C., & Cooper, P. J. (1993). Temperament and major depression in 11 to 16 year olds. *Journal of Child Psychology and Psychiatry*, *34*(8), 1409–1423.

Gordon, M. (2003). Roots of empathy: Responsive parenting, caring societies. *The Keio Journal of Medicine*, *52*(4), 236–243.
Green, S. B. (1991). How many subjects does it take to do a regression analysis. *Multivariate Behavioral Research*, *26*(3), 499–510.
Greenhalgh, J., Dowey, A. J., Horne, P. J., Fergus Lowe, C., Griffiths, J. H., & Whitaker, C. J. (2009). Positive- and negative peer modelling effects on young children's consumption of novel blue foods. *Appetite*, *52*(3), 646–653. https://doi.org/10.1016/j.appet.2009.02.016
Greer, R., Dorow, L., Williams, G., McCorkle, N., & Asnes, R. (1991). Peer-Mediated Procedures To Induce Swallowing and Food Acceptance in Young Children. *Journal of Applied Behaviour Analysis*, *24*, 783–790. https://doi.org/10.1901/jaba.1991.24-783
Gribble, L. S., Falciglia, G., Davis, A. M., & Couch, S. C. (2003). A curriculum based on social learning theory emphasizing fruit exposure and positive parent child-feeding strategies: A pilot study. *Journal of the American Dietetic Association*, *103*(1), 100–103. https://doi.org/10.1053/jada.2003.50011
Gross, J.J. (1999). Emotion and emotion regulation. In Pervin, L.A. & John, O.P. (Eds.). *Handbook of personality: Theory and Research (2nd ed.) pp. 525-552. New York: Guildford.*
Grotevant, H. D., & Carlson, C. I. (1989). *Family assessment: A guide to methods and measures*. Guildford Press.
Gubbels, J. S., Kremers, S. P. J., Stafleu, A., Dagnelie, P. C., Goldbohm, R. A., de Vries, N. K., & Thijs, C. (2009). Diet-related restrictive parenting practices. Impact on dietary intake of 2-year-old children and interactions with child characteristics. *Appetite*, *52*(2), 423–429. https://doi.org/10.1016/j.appet.2008.12.002
Hafstad, G. S., Abebe, D. S., Torgersen, L., & von Soest, T. (2013). Picky eating in preschool children: The predictive role of the child's temperament and mother's negative affectivity. *Eating Behaviors*, *14*(3), 274–277. https://doi.org/10.1016/j.eatbeh.2013.04.001
Hafstad, G., von Soest, T., & Torgersen, L. (2013). Early childhood precursors for eating problems in adolescence: A 15-year longitudinal community study. *Journal of Eating Disorders*, *1*(1), p. 35. https://doi.org/10.1186/2050-2974-1-35
Hagekull, B. (1985). The baby and toddler behavior questionnaires: empirical studies and conceptual considerations. *Scandinavian Journal of Psychology*, *26*(1), 110–122.
Hagekull, B., & Bohlin, G. (1995). Day care quality, family and child characteristics and socioemotional development. *Early Childhood Research Quarterly*, *10*(4), 505–526.
Hagekull, B., Bohlin, G., Rydell, A.-M., & Mothander, P. R. (1996). Maternal sensitivity, infant temperament, and the development of early feeding problems. *Infant Behavior and Development, 18 (1), 92-106*. https://doi.org/10.1016/S0163-6383(96)90543-3
Hagekull, B., & Dahl, M. (1987). Infants with and without feeding difficulties: Maternal experiences. *International Journal of Eating Disorders*, *6*(1), 83–98. https://doi.org/10.1002/1098-108X(198701)6:1<83::AID-

EAT2260060111>3.0.CO;2-1

Hales, C. N., & Barker, D. J. P. (2001). The thrifty phenotype hypothesis: Type 2 diabetes. *British Medical Bulletin*, *60*(1), 5–20. https://doi.org/10.1093/bmb/60.1.5

Harper, L. V, & Karen, M. (1975). *20, 206-214 (1975)*. 206–214.

Harris, G., & Booth, I. W. (1992). The Nature and Management of Eating Problems in Preschool Children In Cooper, P.J., & Stein, A (eds). *Feeding Problems and Eating Disorders in Children and Adolescents*, *Monographs in Clinical Pediatrics*, *5*, Chur, Switzerland: Harwood Academic Publishers.

Harris, H. A., Fildes, A., Mallan, K. M., & Llewellyn, C. H. (2016). Maternal feeding practices and fussy eating in toddlerhood: a discordant twin analysis. *The International Journal of Behavioral Nutrition and Physical Activity*, *13*, 81. https://doi.org/10.1186/s12966-016-0408-4

Haszard, J. J., Skidmore, P. M., Williams, S. M., & Taylor, R. W. (2014). Associations between parental feeding practices, problem food behaviours and dietary intake in New Zealand overweight children aged 4-8 years. *Public Health Nutrition*, *18*(17), 1–8. https://doi.org/10.1017/S1368980014001256

Haukoos, S.J., & Lewis, R.J. (2005). Advanced Statistics: Bootstrapping confidence intervals with dificult distributions. *Academic Emergency Medicine, 12 (4), 360-365*

Hauser, G. J., Chitayat, D., Berns, L., Braver, D., & Muhlbauer, B. (1985). Peculiar odours in newborns and maternal prenatal ingestion of spicy food. *European Journal of Pediatrics*, *144*(4), 403. https://doi.org/10.1007/BF00441788

Hausner, H., Nicklaus, S., Issanchou, S., Mølgaard, C., & Møller, P. (2010). Breastfeeding facilitates acceptance of a novel dietary flavour compound. *Clinical Nutrition*, *29*(1), 141–148. https://doi.org/10.1016/j.clnu.2009.11.007

Haycraft, E.L., & Blissett, J. (2008). Controlling feeding practices and psychopathology in a non-clinical sample of mothers and fathers. *Eating Behaviors*, *9*(4), 484–492. https://doi.org/10.1016/j.eatbeh.2008.07.007

Haycraft, E.L., Farrow, C., Meyer, C., Powell, F., & Blissett, J. (2011). Relationships between temperament and eating behaviours in young children. *Appetite*, *56*(3), 689–692. https://doi.org/10.1016/j.appet.2011.02.005

Haycraft, E. L., & Blissett, J. M. (2008). Maternal and Paternal Controlling Feeding Practices: Reliability and Relationships With BMI. *Obesity*, *16*(7), 1552–1558. https://doi.org/10.1038/oby.2008.238

Haycraft, E.L. & Blissett, J. (2012). Predictors of maternal and paternal controlling feeding practices with 2- 5 year old children. *Journal of Nutrition Education and Behaviour, 44 (5), 390-397.*

Haycraft, E.L., Farrow, C. & Blissett, J. (2013). Maternal symtoms of depression are related to observations of controlling feeding practices in mothers of young children. *Journal of Family Psychology, 27 (1), 159-164.*

Hayes, A. F. (2013). *The PROCESS macro for SPSS and SAS (version 2.13)[Software]*.

Hayes, J. E., Bartoshuk, L. M., Kidd, J. R., & Duffy, V. B. (2008). Supertasting and PROP bitterness depends on more than the TAS2R38 gene. *Chemical Senses*, *33*(3), 255–265.

Haywood, P., & McCann, J. (2009). A Brief Group Intervention for Young Children with Feeding Problems. *Clinical Child Psychology and Psychiatry*, *14*(3), 361–372. https://doi.org/10.1177/1359104509104046

He, K., Hu, F. B., Colditz, G. A., Manson, J. E., Willett, W. C., & Liu, S. (2004). Changes in intake of fruits and vegetables in relation to risk of obesity and weight gain among middle-aged women. *International Journal of Obesity*, *28*(12), 1569–1574. https://doi.org/10.1038/sj.ijo.0802795

Heim, S., Stang, J., & Ireland, M. (2009). A Garden Pilot Project Enhances Fruit and Vegetable Consumption among Children. *Journal of the American Dietetic Association*, *109*(7), 1220–1226. https://doi.org/10.1016/j.jada.2009.04.009

Hendy, H.M. (2002). Effectiveness of trained peer models to encourage food acceptance in preschool children. *Appetite*, *39*(3), 217–225. https://doi.org/10.1006/APPE.2002.0510

Hendy, H M, & Raudenbush, B. (2000). Effectiveness of teacher modeling to encourage food acceptance in preschool children. *Appetite*, *34*(1), 61–76. https://doi.org/10.1006/appe.1999.0286

Hendy, H. M., Williams, K. E., & Camise, T. S. (2005). “Kids Choice” School lunch program increases children’s fruit and vegetable acceptance. *Appetite*, *45*(3), 250–263. https://doi.org/10.1016/j.appet.2005.07.006

Hendy, H.M., Williams, K. E., Riegel, K., & Paul, C. (2010). Parent mealtime actions that mediate associations between children’s fussy-eating and their weight and diet. *Appetite*, *54*(1), 191–195. https://doi.org/10.1016/j.appet.2009.10.006

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): construct validity and normative data in a large non-clinical sample. *The British Journal of Clinical Psychology / the British Psychological Society*, *44*(Pt 2), 227–239. https://doi.org/10.1348/014466505X29657

Highberger, R., & Carothers, L. (1977). Modification of eating behavior of toddlers in a day care setting. *Home Economics Research Journal*, *6*(1), 48–51.

Hoddinott, J., Maluccio, J., Behrman, J., Martorell, R., Melgar, P., Quisumbing, A., … Yount, K. (2011). The Consequences of Early Childhood Growth Failure over the Life Course.In *International Food Policy Research Institute, pp. 1-48*.

Holley, C.E., Farrow, C. & Haycraft, E.L. (2018). If at first you don't succeed: Assessing influences associated with mothers' reoffering of vegetables to preschool age children, *Appetite, 123 (1), 249-255. https://* doi: 10.1016/j.appet.2017.12.026.

Horodynski, M. A., Brophy-Herb, H., Henry, M., Smith, K. A., & Weatherspoon, L. (2009). Toddler feeding: Expectations and experiences of low-income African American mothers. *Health Education Journal*, *68*(1), 14–25. https://doi.org/10.1177/0017896908100445

Houston-Price, C., Burton, E., Hickinson, R., Inett, J., Moore, E., Salmon, K., & Shiba, P. (2009). Picture book exposure elicits positive visual preferences in toddlers. *Journal of Experimental Child Psychology*, *104*(1), 89–104. https://doi.org/10.1016/j.jecp.2009.04.001

Houston-Price, C., Butler, L., & Shiba, P. (2009). Visual exposure impacts on toddlers' willingness to taste fruits and vegetables. *Appetite*, *53*(3), 450–453. https://doi.org/10.1016/j.appet.2009.08.012
Hu, F. (2008). *Obesity epidemiology*. Oxford University Press.
Hughes, S. O., Shewchuk, R. M., Baskin, M. L., Nicklas, T. a, & Qu, H. (2008). Indulgent feeding style and children's weight status in preschool. *Journal of Developmental and Behavioral Pediatrics : JDBP*, *29*(5), 403–410. https://doi.org/10.1097/DBP.0b013e318182a976
Huizink, A. C., Zentner, M., & Shiner, R. L. (2012). Prenatal factors in temperament: The role of prenatal stress and substance use exposure. *Handbook of Temperament*, 297–315.
Hunter, J. L. (2005). Cervical cancer educational pamphlets: Do they miss the mark for Mexican immigrant women's needs? *Cancer Control: Journal of the Moffitt Cancer Center*, *12 Suppl 2*(November), 42–50. https://doi.org/10.1177/107327480501200 4S07
Hurley, K. M., Black, M. M., Papas, M. a, & Caulfield, L. E. (2008). Maternal symptoms of stress, depression, and anxiety are related to nonresponsive feeding styles in a statewide sample of WIC participants. *The Journal of Nutrition*, *138*(4), 799–805. https://doi.org/138/4/799 [pii]
Inglis, N. J., Docherty, A., & Pryke, R. (2010). Evaluation of the 'Mealtime Magic' brief leaflet-based intervention in general practice. *Primary Health Care Research and Development*, *11*(2), 166–179. https://doi.org/10.1017/S1463423609990326
Jacobi, C., Agras, W. S., Bryson, S., & Hammer, L. D. (2003). Behavioral validation, precursors, and concomitants of picky eating in childhood. *Journal of the American Academy of Child and Adolescent Psychiatry*, *42*(1), 76–84. https://doi.org/10.1097/00004703-200306000-00025
Jacobi, C., Schmitz, G., & Agras, W. S. (2008). Is picky eating an eating disorder? *International Journal of Eating Disorders, 41, 626-634*. https://doi.org/10.1002/eat.20545
Jain, A., Sherman, S. N., Chamberlin, L. A., Carter, Y., Powers, S. W., & Whitaker, R. C. (2001). Why don't low-income mothers worry about their preschoolers being overweight? *Pediatrics*, *107*(5), 1138–1146.
Jansen, P. W., de Barse, L. M., Jaddoe, V. W. V., Verhulst, F. C., Franco, O. H., & Tiemeier, H. (2017). Bi-directional associations between child fussy eating and parents' pressure to eat: Who influences whom? *Physiology & Behavior*, 176, 101-106. https://doi.org/10.1016/j.physbeh.2017.02.015
Jansen, P. W., Roza, S. J., Jaddoe, V. W., Mackenbach, J. D., Raat, H., Hofman, A., … Tiemeier, H. (2012). Children's eating behavior, feeding practices of parents and weight problems in early childhood: results from the population-based Generation R Study. *The International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 130. https://doi.org/10.1186/1479-5868-9-130
Jarrett, R. L., Bahar, O. S., & Kersh, R. T. (2014). "When We Do Sit Down Together." *Journal of Family Issues*, *37*(11), 1483–1513. https://doi.org/10.1177/0192513x14547417

Jennings, A., Davies, G. J., Costarelli, V., & Dettmar, P. W. (2009). Dietary fibre, fluids and physical activity in relation to constipation symptoms in pre-adolescent children. *Journal of Child Health Care*, *13*(2), 116–127. https://doi.org/10.1177/1367493509102469

Johannsen, D.L., Johannsen, N.M., & Specker, B.L. (2006). Influence of parents' eating behaviours and child feeding practices on children's weight status. *Obesity, 14 (3), 431-439*

Johnson, S. L, Bellows, L., Beckstrom, L., & Anderson, J. (2007). Campaign Targeting Preschool Children. *American Jorunal of Health Behaviour*, *31*(1), 44–55. https://doi.org/10.5993/AJHB.31.1.5

Johnson, S. L. (2002). Children's food acceptance patterns: the interface of ontogeny and nutrition needs. *Nutr Rev*, *60*(5 Pt 2), 9,1-4. https://doi.org/10.1301/00296640260130812

Kagan, J., & Snidman, N. (1991). Infant Predictors of Inhibited and Uninhibited Profiles. *Psychological Science*, *2*(1), 40–44. https://doi.org/10.1111/j.1467-9280.1991.tb00094.x

Kagan, J. (1998). Biology and the child. In Eisenberg, N. (Ed.) & Damon, W. (Series Ed.), *Handbook of child psychology: Vol 3, social, emotional and personality development (pp. 177-235*). New York: Wiley.

Kaiser, L. L., Melgar-Quinonez, H. R., Lamp, C. L., Johns, M. C., & Harwood, J. O. (2001). Acculturation of Mexican-American mothers influences child feeding strategies. *Journal of the American Dietetic Association*, *101*(5), 542–547.

Kaminski, L. C., Henderson, S. A., & Drewnowski, A. (2000). Young women's food preferences and taste responsiveness to 6-n-propylthiouracil (PROP). *Physiology & Behavior*, *68*(5), 691–697. https://doi.org/10.1016/S0031-9384(99)00240-1

Kauer, J., Pelchat, M. L., Rozin, P., & Zickgraf, H. F. (2015). Adult picky eating. Phenomenology, taste sensitivity, and psychological correlates. *Appetite*, *90*, 219–228. https://doi.org/10.1016/j.appet.2015.03.001

Kelder, S. H., Perry, C. L., Klepp, K. I., & Lytle, L. L. (1994). Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors. *American Journal of Public Health*, *84*(7), 1121–1126. https://doi.org/10.2105/AJPH.84.7.1121

Keller, K. L., Steinmann, L., Nurse, R. J., & Tepper, B. J. (2002). Genetic taste sensitivity to 6-n-propylthiouracil influences food preference and reported intake in preschool children. *Appetite*, *38*(1), 3–12. https://doi.org/10.1006/APPE.2001.0441

Key, T. J. A., Appleby, P. N., Thorogood, M., & Burr, M. L. (1996). Dietary habits and mortality in 11 000 vegetarians and health conscious people: Results of a 17 year follow up. *Bmj*, *313*(7060), 775–779. https://doi.org/10.1136/bmj.313.7060.775

Kidwell, K.M., Kozikowski, C., Roth, T., Lundahl, A., & Nelson, T.D. (2018). Concurrent and longitudinal associations among temperament, parental feeding styles and selective eating in a preschool sample. *Journal of Paediatric Psychology, 43 (5), 572-583*

kim, Y., Chung, S.-J., Han, Y. S., Lee, S. Il, Lee, Y., & Choi, H. (2006). The characteristics of infants' temperament and eating behavior, maternal eating behavior and

feeding practices in picky eaters. *The FASEB Journal*, *20*(4), A174.
Klesges, R. C., Coates, T. J., Brown, G., Sturgeon-Tillisch, J., Moldenhauer-Klesges, L. M., Holzer, B., … Vollmer, J. (1983). Parental influences on children’s eating behavior and relative weight. *Journal of Applied Behavior Analysis*, *16*(4), 371–378. https://doi.org/10.1901/jaba.1983.16-371
Kotler, L. a, Cohen, P., Davies, M., Pine, D. S., & Walsh, B. T. (2001). Longitudinal relationships between childhood, adolescent, and adult eating disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *40*(12), 1434–1440. https://doi.org/10.1097/00004703-200206000-00029
Koulouglioti, C., Cole, R., & Moskow, M. (2011). Single Mothers’ Views of Young Children’s Everyday Routines: A Focus Group Study. *Journal of Community Health Nursing*, *28*(3), 144–155. https://doi.org/10.1080/07370016.2011.589236
Kramer, H.C., & Blasey, C.M. (2004). Centering in regression analyses: a strategy to prevent errors in statistical inference. *International Journal of Methods in Psychiatric Research, 13 (3), 141-151.*
Kwok, F. Y. Y., Ho, Y. Y. F., Chow, C. M., So, C. Y. N., & Leung, T. F. (2013). Assessment of nutrient intakes of picky-eating Chinese preschoolers using a modified food frequency questionnaire. *World Journal of Pediatrics*, *9*(1), 58–63. https://doi.org/10.1007/s12519-012-0386-9
Lam, C. B., & McHale, S. M. (2012). Developmental patterns and family predictors of adolescent weight concerns: A replication and extension. *International Journal of Eating Disorders*, *45*(4), 524–530.
Lamb, M. E. (2004). *The role of the father in child development (3rd ed.)*. New York: Wiley.
Larson, R. W., Branscomb, K. R., & Wiley, A. R. (2006). Forms and functions of family mealtimes: Multidisciplinary perspectives. *New Directions for Child and Adolescent Development*, *2006*(111), 1–15. https://doi.org/10.1002/cd.152
Ledoux, T. A., Hingle, M. D., & Baranowski, T. (2011). Relationship of fruit and vegetable intake with adiposity: a systematic review. *Obesity Reviews*, *12*(5), e143–e150. https://doi.org/10.1111/j.1467-789X.2010.00786.x
Lee, C. W., Taylor, G., & Dunn, J. (1999). Factor structure of the schema questionnaire in a large clinical sample. *Cognitive Therapy and Research*, *23*(4), 441–451.
Lepper, M. R., Greene, D., & Nisbett, R. E. (1973). Undermining children’s intrinsic interest with extrinsic reward: A test of the “overjustification” hypothesis. *Journal of Personality and Social Psychology*, *28*(1), 129–137. https://doi.org/10.1037/h0035519
Leung, N., Waller, G., & Thomas, G. (2000). Outcome of group cognitive-behavior therapy for bulimia nervosa: The role of core beliefs. *Behaviour Research and Therapy*, *38*(2), 145–156.
Lewis, M., & Worobey, J. (2011). Mothers and toddlers lunch together. The relation between observed and reported behavior. *Appetite*, *56*(3), 732–736.
Li, Z., van der Horst, K., Edelson-Fries, L. R., Yu, K., You, L., Zhang, Y., … Wang, J. (2017). Perceptions of food intake and weight status among parents of picky eating infants and toddlers in China: A cross-sectional study. *Appetite*, *108*, 456–463. https://doi.org/10.1016/j.appet.2016.11.009

Liquori, T., Koch, P. D., Contento, R. I., & Castle, J. (1998). The Cookshop Program: Outcome Evaluation of a Nutrition Education Program Linking Lunchroom Food Experiences with Classroom Cooking Experiences. *Journal of Nutrition Education*, *30*(5), 302–313. https://doi.org/10.1016/S0022-3182(98)70339-5

Liss, M., Saulnier, C., Fein, D., & Kinsbourne, M. (2006). Sensory and attention abnormalities in autistic spectrum disorders. *Autism*, *10*(2), 155–172. https://doi.org/10.1177/1362361306062021

Little, C., & Carter, A. S. (2005). Negative emotional reactivity and regulation in 12-month-olds following emotional challenge: Contributions of maternal-infant emotional availability in a low-income sample. *Infant Mental Health Journal*, *26*(4), 354–368. https://doi.org/10.1002/imhj.20055

Liu, S., Manson, J. E., Lee, I., Cole, S. R., Hennekens, C. H., Willett, W. C., & Buring, J. E. (2000). Fruit and vegetable intake and risk of cardiovascular disease: the Women 's Health Study. *American Journal of Clinical Nutrition*, *79*(4), 922–928.

Liu, X., & Lv, K. (2013). Cruciferous vegetables intake is inversely associated with risk of breast cancer: a meta-analysis. *Breast (Edinburgh, Scotland)*, *22*(3), 309–313. https://doi.org/10.1016/j.breast.2012.07.013

Locke III, G. R., Pemberton, J. H., & Phillips, S. F. (2000). AGA technical review on constipation. *Gastroenterology*, *119*(6), 1766–1778. https://doi.org/10.1053/gast.2000.20392

Lovibond, P. F. (2004). Cognitive processes in extinction. *Learning & Memory*, *11*(5), 495–500.

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3), 335–343.

Lowe, C. F., Horne, P. J., Tapper, K., Bowdery, M., & Egerton, C. (2004). Effects of a peer modelling and rewards-based intervention ot increase fruit vegetable consumption in children. *European Journal of Clinical Nutrition*, *58*(3), 510–522. https://doi.org/10.1038/sj.ejcn.1601838

Luchini, V., Lee, S. Y., & Donovan, S. (2016). Observed differences in child picky eating behaviors between the child's home and centre-or home-based childcare. *FASEB Journal. 30*(1). https://doi.org/10.1016/j.appet.2017.04.021

Lumeng, Jessica C, Gannon, K., Appugliese, D., Cabral, H. J., & Zuckerman, B. (2005). Preschool child care and risk of overweight in 6-to 12-year-old children. *International Journal of Obesity*, *29*(1), 60-66.

Lumeng, Julie C., & Burke, L. M. (2006). Maternal prompts to eat, child compliance, and mother and child weight status. *Journal of Pediatrics*, *149*(3), 330-335. https://doi.org/10.1016/j.jpeds.2006.04.009

Ma, G. (2015). Food, eating behavior, and culture in Chinese society. *Journal of Ethnic Foods*, *2*(4), 195–199. https://doi.org/10.1016/j.jef.2015.11.004

Maccoby, E. E., Martin, J. A. (1983). Socialization in the context of the family: Parent-child interaction. InMussen, P. H., & Hetherington, E. (Eds.), *Handbook of child psychology: Socialization, personality and social development, Vol 4, (pp. 1-*

101).New York: Wiley
Machado, B. C., Dias, P., Lima, V. S., Campos, J., & Gonçalves, S. (2016). Prevalence and correlates of picky eating in preschool-aged children: A population-based study. *Eating Behaviors*, *22*, 16–21.
Maier, A., Chabanet, C., Schaal, B., Issanchou, S., & Leathwood, P. (2007). Effects of repeated exposure on acceptance of initially disliked vegetables in 7-month old infants. *Food Quality and Preference*, *18*(8), 1023–1032. https://doi.org/10.1016/j.foodqual.2007.04.005
Maitre, I., Van Wymelbeke, V., Amand, M., Vigneau, E., Issanchou, S., & Sulmont-Rossé, C. (2014). Food pickiness in the elderly: Relationship with dependency and malnutrition. *Food Quality and Preference*, *32*, 145–151. https://doi.org/10.1016/j.foodqual.2013.04.003
Mahtani, K., Spencer, E.A., Brassey, J., & Heneghan, C. (2018). Catalogue of bias: observer bias. *British Medical Journal, 23 (1)*
Mallan, K. M., Liu, W. H., Mehta, R. J., Daniels, L. a., Magarey, A., & Battistutta, D. (2013). Maternal report of young children's eating styles. Validation of the Children's Eating Behaviour Questionnaire in three ethnically diverse Australian samples. *Appetite*, *64*, 48–55. https://doi.org/10.1016/j.appet.2013.01.003
Marchi, M., & Cohen, P. (1990). Early childhood eating behaviors and adolescent eating disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *29*(1), 112–117. https://doi.org/10.1097/00004583-199001000-00017
Martins, Y., & Pliner, P. (2005). Human food choices: An examination of the factors underlying acceptance/rejection of novel and familiar animal and nonanimal foods. *Appetite*, *45*(3), 214–224.
Martorell, R. (1999). The nature of child malnutrition and its long-term implications. *Food and Nutrition Bulletin*, *20*(3), 288–292.
Mascola, A. J., Bryson, S. W., & Agras, W. S. (2010). Picky eating during childhood: A longitudinal study to age 11years. *Eating Behaviors, 11, 253-257*. https://doi.org/10.1016/j.eatbeh.2010.05.006
Mathiesen, K. S., & Tambs, K. (1999). The EAS Temperament Questionnaire-Factor Structure, Age Trends, Reliability, and Stability in a Norwegian Sample. *Journal of Child Psychology and Psychiatry*, *40*(3), 431–439. https://doi.org/10.1111/1469-7610.00460
May, A. L., Kim, J., McHale, S. M., & C. Crouter, A. (2006). Parent–adolescent relationships and the development of weight concerns from early to late adolescence. *International Journal of Eating Disorders*, *39*(8), 729–740.
Mayeaux, M., Donovan, S., Lee, S.-Y., & Moskowitz, H. (2010). Defining Perceptions of Picky Eater Children by Conjoint Analysis. *Journal of Nutrition Education and Behaviour*, *42*(4), S77.
Mazurek, M. O., Vasa, R. A., Kalb, L. G., Kanne, S. M., Rosenberg, D., Keefer, A., … Lowery, L. A. (2013). Anxiety, sensory over-responsivity, and gastrointestinal problems in children with autism spectrum disorders. *Journal of Abnormal Child Psychology*, *41*(1), 165–176.
McClowry, S. G. (2002). The temperament profiles of school-age children. *Journal of Pediatric Nursing*, *17*(1), 3–10. https://doi.org/10.1053/jpdn.2002.30929

McCormick, V., & Markowitz, G. (2013). Picky eater or feeding disorder? Strategies for determining the difference. *Advanced Healthcare Network for NPs & PAs*, *4*(3), 18–22.
McDermott, B. M., Mamun, A. A., Najman, J. M., Williams, G. M., O'Callaghan, M. J., & Bor, W. (2010). Longitudinal correlates of the persistence of irregular eating from age 5 to 14 years. *Acta Paediatrica, International Journal of Paediatrics*, *99*(1), 68–71. https://doi.org/10.1111/j.1651-2227.2009.01517.x
McDermott, Brett M, Mamun, A. a, Najman, J. M., Williams, G. M., O'callaghan, M. J., & Bor, W. (2008). Preschool children perceived by mothers as irregular eaters: physical and psychosocial predictors from a birth cohort study. *Journal of Developmental and Behavioral Pediatrics : JDBP*, *29*(3), 197–205. https://doi.org/10.1097/DBP.0b013e318163c388
McGuire, J., & Richman, N. (1986). Screening for Behaviour Problems in Nurseries: the Reliability and Validity of the Preschool Behaviour Checklist. *Journal of Child Psychology and Psychiatry*, *27*(1), 7–32. https://doi.org/10.1111/j.1469-7610.1986.tb00618.x
McHale, J. P. (1995). Coparenting and triadic interactions during infancy: The roles of marital distress and child gender. *Developmental Psychology*, *31*(6), 985-996.
McMeekin, S., Jansen, E., Mallan, K., Nicholson, J., Magarey, A., & Daniels, L. (2013). Associations between infant temperament and early feeding practices. A cross-sectional study of Australian mother-infant dyads from the NOURISH randomised controlled trial. *Appetite, 60* (1), 239-245. https://doi.org/10.1016/j.appet.2012.10.005
Mebert, C.J. (1991). Dimensions of subjectivity in parents' ratings of infant temperament. *Child Development, 62 (2), 352-361.*
Melby, J., Conger, R., Book, R., Rueter, M., Lucy, L., Repinski, D., … Scaramella, L. (1998). The Iowa Family Interaction Rating Scales. Ames: Iowa State University.
Mennella, J. A., & Beauchamp, G. K. (1991). The transfer of alcohol to human milk: Effects on flavor and the infant's behavior. *New England Journal of Medicine*, *325*(14), 981–985.
Mennella, J. A., Forestell, C. A., Morgan, L. K., & Beauchamp, G. K. (2009). Early milk feeding influences taste acceptance and liking during infancy. *American Journal of Clinical Nutrition*, *90*(3), 780–788. https://doi.org/10.3945/ajcn.2009.27462O
Mennella, J. A., Jagnow, C., & Beauchamp, G. K. (2001). Prenatal and postnatal flavor learning by human infants. *Pediatrics*, *107*(6), E88. https://doi.org/10.1016/j.pestbp.2011.02.012.Investigations
Mennella, J. A., Johnson, A., & Beauchamp, G. K. (1995). Garlic ingestion by pregnant women alters the odor of amniotic fluid. *Chemical Senses*, *20*(2), 207–209. https://doi.org/10.1093/chemse/20.2.207
Meyer, E. C., Coll, C. T. G., Lester, B. M., Boukydis, C. F. Z., McDonough, S. M., & Oh, W. (1994). Family-based intervention improves maternal psychological well-being and feeding interaction of preterm infants. *Pediatrics*, *93*(2), 241–246.
Micali, N., Simonoff, E., Elberling, H., Rask, C. U., Olsen, E. M., & Skovgaard, A. M. (2011). Eating Patterns in a Population-Based Sample of Children Aged 5 to 7

Years: Association With Psychopathology and Parentally Perceived Impairment. *Journal of Developmental & Behavioral Pediatrics*, *32*(8), 572-580. https://journals.lww.com/jrnldbp/Fulltext/2011/10000

Micali, N., Simonoff, E., Stahl, D., & Treasure, J. (2011). Maternal eating disorders and infant feeding difficulties: Maternal and child mediators in a longitudinal general population study. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *52*(7), 800–807. https://doi.org/10.1111/j.1469-7610.2010.02341.x

Migraine, A., Nicklaus, S., Parnet, P., Lange, C., Monnery-Patris, S., Des Robert, C., … Roze, J.-C. (2013). Effect of preterm birth and birth weight on eating behavior at 2 y of age. *The American Journal of Clinical Nutrition*, *97*(6), 1270–1277.

Mikkilä, V., Räsänen, L., Raitakari, O. T., Pietinen, P., & Viikari, J. (2004). Longitudinal changes in diet from childhood into adulthood with respect to risk of cardiovascular diseases: The Cardiovascular Risk in Young Finns Study. *European Journal of Clinical Nutrition*, *58*(7), 1038–1045. https://doi.org/10.1038/sj.ejcn.1601929

Mitchell, G. L., Farrow, C., Haycraft, E., & Meyer, C. (2013). Parental influences on children's eating behaviour and characteristics of successful parent-focussed interventions. *Appetite*, Vol. 60, pp. 85–94. https://doi.org/10.1016/j.appet.2012.09.014

Mitchell, S., Brennan, L., Hayes, L., & Miles, C. L. (2009). Maternal psychosocial predictors of controlling parental feeding styles and practices. *Appetite*, *53*(3), 384–389. https://doi.org/10.1016/j.appet.2009.08.001

Moding, K. J., & Stifter, C. A. (2016). Temperamental approach/withdrawal and food neophobia in early childhood: Concurrent and longitudinal associations. *Appetite*, *107*, 654–662. https://doi.org/10.1016/j.appet.2016.09.013

Momin, S. R., Hughes, S. O., Elias, C., Papaioannou, M. A., Phan, M., Vides, D., & Wood, A. C. (2018). Observations of Toddlers' sensory-based exploratory behaviors with a novel food. *Appetite*, *131*(August), 108–116. https://doi.org/10.1016/j.appet.2018.08.035

Monteiro, C. A., Moubarac, J., Cannon, G., Ng, S. W., & Popkin, B. (2013). Ultra-processed products are becoming dominant in the global food system. *Obesity Reviews*, *14*, 21–28.

Mooney, C.Z. & Duvall, R. D. (1993). Bootstrapping: A non-parametric approach to statistical inference. Newbury Park: Sage

Moore, S. N., Tapper, K., & Murphy, S. (2010). Feeding goals sought by mothers of 3-5-year-old children. *British Journal of Health Psychology*, *15*(1), 185–196. https://doi.org/10.1348/135910709X447668

Morris, J. L., & Zidenberg-Cherr, S. (2002). Garden-enhanced nutrition curriculum improves fourth-grade school children's knowledge ol nutrition and preferences lor some vegetables. *Journal of the American Dietetic Association*, 102, (*1)*, 91-93.

Murphy, S., & Smith, C. (1993). Crutches, confetti or useful tools? Professionals, views on and use of health education leaflets. *Health Education Research*, *8*(2), 205–215. http://dx.doi.org/10.1093/her/8.2.205

Musher-Eizenman, D. & Holub, S. (2007). Comprehensive feeding practices questionnaire: Validation of a new measure of parental feeding practices, *Journal*

of Paediatric Psychology, 32 (8), 960-972
Myers, R. H., & Myers, R. H. (1990). *Classical and modern regression with applications* (Vol. 2). Duxbury press Belmont, CA.
Myers, T. (2011). Goodbye listwise deletion: Presenting hot deck imputation as an easy and effective tool for handling missing data. *Communication Methods and Measures, 5 (4), 297-310.*
Nederkoorn, C., Jansen, A., & Havermans, R. C. (2015). Feel your food. The influence of tactile sensitivity on picky eating in children. *Appetite*, *84*, 7–10. https://doi.org/10.1016/j.appet.2014.09.014
Nederkoorn, C., Theiβen, J., Tummers, M., & Roefs, A. (2018). Taste the feeling or feel the tasting: Tactile exposure to food texture promotes food acceptance. *Appetite*, *120*, 297–301. https://doi.org/10.1016/j.appet.2017.09.010
NELFT tips for fussy eaters: https://www.nelft.nhs.uk/download.cfm?doc=docm93jijm4n1862.pdf&ver=2939 (assessed 13/5/17)
Neumark-Sztainer, D., Hannan, P. J., Story, M., Croll, J., & Perry, C. (2003). Family meal patterns: Associations with sociodemographic characteristics and improved dietary intake among adolescents. *Journal of the American Dietetic Association*, *103*(3), 317–322. https://doi.org/10.1053/jada.2003.50048
Newman, J, & Taylor, A. (1992). Effect of a mean-end contingency on young children's food preferences. *Journal of Experimental Child Psychology*, *64*, 200–216.
Newman, Joan, & Layton, B. D. (1984). Over Justification: A Self-Perception Perspective. *Personality and Social Psychology Bulletin*, *10*(3), 419–425. https://doi.org/10.1177/0146167284103010
NHS. (2011). National Health Service. *5 A DAY fruit and vegetable scheme*: https://www.nhs.uk/live-well/eat-well/school-fruit-and-vegetable-scheme/ (assessed 9/3/15)
NHS. (2013). National Health Service. 5 A DAY portion sizes: https://www.nhs.uk/live-well/eat-well/5-a-day-portion-sizes/ (assessed 9/3/15)
Nicholls, D., Christie, D., Randall, L., & Lask, B. (2001). Selective Eating - symptom,disorder or normal variant. *Clinical Child Psychology and Psychiatry, 6, 257-270*
Nicklaus, S., Boggio, V., Chabanet, C., & Issanchou, S. (2005). A prospective study of food variety seeking in childhood, adolescence and early adult life. *Appetite*, *44*, 289–297. https://doi.org/10.1016/j.appet.2005.01.006
Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, *84*(3), 231–259. https://doi.org/10.1037/0033-295X.84.3.231
Noldus Information Technology, bv. (2008). *The Observer XT (Version 8.0)[Computer software]*. Author Wageningen, the Netherlands.
Northstone, K., Emmett, P., & Nethersole, F. (2001). The effect of age of introduction to lumpy solids on foods eaten and reported feeding difficulties at 6 and 15 months. *Journal of Human Nutrition and Dietetics*, *14*(1), 43–54. https://doi.org/10.1046/j.1365-277X.2001.00264.x

Northstone, Kate, & Emmett, P. (2013). The associations between feeding difficulties and behaviours and dietary patterns at 2 years of age: The ALSPAC cohort. *Maternal and Child Nutrition*, *9*(4), 533–542. https://doi.org/10.1111/j.1740-8709.2012.00399.x

Norton, P. J. (2007). Depression Anxiety and Stress Scales (DASS-21): Psychometric analysis across four racial groups. *Anxiety, Stress, and Coping*, *20*(3), 253–265.

Nöthlings, U., Schulze, M. B., Weikert, C., Boeing, H., van der Schouw, Y. T., Bamia, C., … Trichopoulo, A. (2008). Intake of vegetables, legumes, and fruit, and risk for all-cause, cardiovascular, and cancer mortality in a European diabetic population. *The Journal of Nutrition*, *138*(4), 775–781. https://doi.org/138/4/775 [pii]

Office for National Statistics (ONS). Statistical bulletin: *families and households, 2001 to 2011.* Newport: Office for National Statistics; 2012 (assessed 8/6/16)

Office of Population Censuses and Surveys (2003). *Census Ethnic Group and Country of Birth (Census User Guide No. 9).* London: HMSO (assessed 8/6/17)

Ogden, J., Reynolds, R., & Smith, A. (2006). Expanding the concept of parental control: A role for overt and covert control in children's snacking behaviour? *Appetite*, *47*(1), 100–106. https://doi.org/10.1016/j.appet.2006.03.330

Olsho, L. E. W., Klerman, J. A., Ritchie, L., Wakimoto, P., Webb, K. L., & Bartlett, S. (2015). Increasing Child Fruit and Vegetable Intake: Findings from the US Department of Agriculture Fresh Fruit and Vegetable Program. *Journal of the Academy of Nutrition and Dietetics*, *115*(8), 1283–1290. https://doi.org/10.1016/j.jand.2014.12.026

Onis, M. De, Frongillo, E. a, & Blössner, M. (2000). Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. B*ulletin World Health Organization*, *78*(1), 1222-1233. https://doi.org/10.1590/S0042-96862000001000008

Orrell-Valente, J. K., Hill, L. G., Brechwald, W. A., Dodge, K. A., Pettit, G. S., & Bates, J. E. (2007). "Just three more bites": An observational analysis of parents' socialization of children's eating at mealtime. *Appetite*, *48*(1), 37–45. https://doi.org/10.1016/j.appet.2006.06.006

Paediasure Shakes. Abbott Laboratories Limited, 2013 (Paediasure Brand).

Patrick, H, & Nicklas, T. a. (2005). A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition*, *24*(2), 83–92. https://doi.org/24/2/83 [pii]

Patrick, H., Nicklas, T. A., Hughes, S. O., & Morales, M. (2005). The benefits of authoritative feeding style: Caregiver feeding styles and children's food consumption patterns. *Appetite*, *44*(2), 243–249. https://doi.org/10.1016/j.appet.2002.07.001

Pelchat, M. L., & Pliner, P. (1986). Antecedents and correlates of feeding problems in young children. *Journal of Nutrition Education and Behavior*, *18*(1), 23–29. https://doi.org/10.1016/S0022-3182(86)80263-1

Pelchat, M. L., & Pliner, P. (1995). "Try it. You'll like it". Effects of information on willingness to try novel foods. *Appetite*, *24*(2), 153–165. https://doi.org/10.1016/S0195-6663(95)99373-8

Pliner, P, & Loewen, E. R. (1997). Temperament and food neophobia in children and their mothers. *Appetite, 28 (3), 239-254*. https://doi.org/10.1006/appe.1996.0078
Pliner, P. (1982). The effects of mere exposure on liking for edible substances. *Appetite*, *3*(3), 283–290.
Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, *19*(2), 105–120.
Plomin, R., & Buss, A. M. (1984). *Temperament: Early developing personality traits*. Hillsdale, NJ, Erlbaum.
Powell, F. C., Farrow, C. V., & Meyer, C. (2011). Food avoidance in children. The influence of maternal feeding practices and behaviours. *Appetite*, *57*(3), 683–692. https://doi.org/10.1016/j.appet.2011.08.011
Ramsay, M., Martel, C., Porporino, M., & Zygmuntowicz, C. (2011). The Montreal children's hospital feeding scale: A brief bilingual screening tool for identifying feeding problems. *Paediatric Child Health, 16 (3), 147-151*
Rauber, F., Campagnolo, P. D. B., Hoffman, D. J., & Vitolo, M. R. (2015). Consumption of ultra-processed food products and its effects on children's lipid profiles: A longitudinal study. *Nutrition, Metabolism and Cardiovascular Diseases*, *25*(1), 116–122. https://doi.org/10.1016/j.numecd.2014.08.001
Reau, N. R., Senturia, Y. D., Lebailly, S. A., & Christoffel, K. K. (1996). Infant and toddler feeding patterns and problems: Normative data and a new direction. *Journal of Developmental and Behavioral Pediatrics*, Vol. 17, pp. 149–153. https://doi.org/10.1097/00004703-199606000-00002
Reiss, R., Johnston, J., Tucker, K., DeSesso, J. M., & Keen, C. L. (2012). Estimation of cancer risks and benefits associated with a potential increased consumption of fruits and vegetables. *Food and Chemical Toxicology*, *50*(12), 4421–4427. https://doi.org/https://doi.org/10.1016/j.fct.2012.08.055
Rekhy, R., & McConchie, R. (2014). Promoting consumption of fruit and vegetables for better health. Have campaigns delivered on the goals? *Appetite*, *79*, 113–123. https://doi.org/10.1016/j.appet.2014.04.012
Remington, A., Añez, E., Croker, H., Wardle, J., & Cooke, L. (2012). Increasing food acceptance in the home setting: A randomized controlled trial of parent-administered taste exposure with incentives. *American Journal of Clinical Nutrition*, *95*(1), 72–77. https://doi.org/10.3945/ajcn.111.024596
Riboli, E., Hunt, K., Slimani, N., Ferrari, P., Norat, T., Fahey, M., … Saracci, R. (2002). European Prospective Investigation into Cancer and Nutrition (EPIC): study populations and data collection. *Public Health Nutrition*, *5*(6b), 1113-1124. https://doi.org/10.1079/PHN2002394
Richman, N., & Graham, P. J. (1971). A behavioural screening questionnaire for use with 3-year-old children: Preliminary findings. *Journal Of Child Psychology And Psychiatry*, *12*(1), 5–33. https://doi.org/10.1111/j.1469-7610.1971.tb01047.x
Rittenmyer, G. J. (1997). The relationship between early maladaptive schemas and job burnout among public school teachers. *Unpublished Doctoral Dissertation: University of the Pacific*

Robinson, T. (2008). Applying the socio-ecological model to improving fruit and vegetable intake among low income African Americans. *Journal of Community Health, 33 (6), 395-406.*

Rogers, S., Ramsey, M., & Blissett, J. (2018). The Montreal's children hospital feeding scale: Relationship with parental report of child feeding behaviours and observed feeding interactions. *Appetite, 125, 201-209.*

Rolls, B. J., Rowe, E. A., & Rolls, E. T. (1982). How sensory properties of foods affect human feeding behavior. *Physiology and Behavior*, *29*(3), 409–417. https://doi.org/10.1016/0031-9384(82)90259-1

Rolls, B. J., Rowe, E. A., Rolls, E. T., Kingston, B., Megson, A., & Gunary, R. (1981). Variety in a meal enhances food intake in man. *Physiology & Behavior*, *26*(2), 215–221.

Rosenberg, M. (1965). *Society and adolescent self image*. Princeton, NJ: Princeton University Press.

Rosenberg, M., Schooler, C., Schoenbach, C., & Rosenberg, F. (1995). Global self-esteem and specific self-esteem: Different concepts, different outcomes. *American Sociological Review*, 141–156.

Rosenstein, D., & Oster, H. (1988). Differential facial responses to four basic tastes in newborns. *Child Development*, 59 (6), 1555–1568.

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The children's behavior questionnaire. *Child Development*, *72*(5), 1394–1408. https://doi.org/10.1111/1467-8624.00355

Rothbart, M.K. & Bates, J. E. (1998). *Temperament*. NJ: Wiley & Sons Inc.; Hoboken.

Rothbart, M.K. (1981). Measurement of Temperament in Infancy. *Child Development*, *52*(2), 569–578. https://doi.org/10.2307/1129176

Rowe, D. C., & Plomin, R. (1977). Temperament in early childhood. *Journal of Personality Assessment*, *41*(2), 150–156.

Rozin, P. (1986). Food Likes and Dislikes. *Annual Review of Nutrition*, *6*(1), 433–456. https://doi.org/10.1146/annurev.nutr.6.1.433

Rozin, P. & Vollmecke, T. A. (1986). Food likes and dislikes. *Annual Review of Nutrition*, *6*(1), 433–456.

Russell, C. G., & Worsley, A. (2013). Why do they like that? And can I do anything about it? The nature and correlates of parents' attributions and self-efficacy beliefs about preschool children's food preferences. *Appetite*, *66*, 34–43. https://doi.org/10.1016/j.appet.2013.02.020

Rydell, A. M., Dahl, M., & Sundelin, C. (1995). Characteristics of school children who are choosy eaters. *The Journal of Genetic Psychology, 156 (2), 217-229*. https://doi.org/10.1080/00221325.1995.9914818

Sameroff, A.J., Seifer, R. & Elias, P.K. (1982). Sociocultural variability in infant temperament ratings. *Child Development, 53 (1), 164-173*

Sanders, M. R., Patel, R. K., Le Grice, B., & Shepherd, R. W. (1993). Children with persistent feeding difficulties: an observational analysis of the feeding interactions of problem and non-problem eaters. *Health Psychology, 12*(1), 64–73. https://doi.org/10.1037/0278-6133.12.1.64

Satter, E. (1986). The feeding relationship. *Journal of the American Dietetic Association,* 86, 352-356

Satter, E. (1990). The feeding relationship: Problems and interventions. *The Journal of Pediatrics, 11 (2), 181-189*. https://doi.org/10.1016/S0022-3476(05)80017-4

Satter, E. (1995). Feeding Dynamics: Helping children to eat well. *Journal of Paediatric Health Care, 9 (4), 178-184.*

Satter, E. (1999). The feeding Relationship. In D.B Kessler & Dawson, P. (Eds). Failure to thrive and paediatric undernutrition. A transdisciplinary approach (pp. 121-149). *Baltimore, MD, US: Paul H Brookes Publishing.*

Saudino, K. J., McGuire, S., Reiss, D., Hetherington, E. M., & Plomin, R. (1995). Parent ratings of EAS temperaments in twins, full siblings, half siblings, and step siblings. *Journal of Personality and Social Psychology*, *68*(4), 723.

Savage, J. S., Fisher, J. O., & Birch, L. L. (2008). Parental influence on eating behavior. *NIH Public Access*, *35*(1), 22–34. https://doi.org/10.1111/j.1748-720X.2007.00111.x.Parental

Saxton, J., Carnell, S., van Jaarsveld, C. H. M., & Wardle, J. (2009). Maternal Education Is Associated with Feeding Style. *Journal of the American Dietetic Association*, *109*(5), 894–898. https://doi.org/10.1016/j.jada.2009.02.010

Schaal, B. (2000). Human Foetuses Learn Odours from their Pregnant Mother's Diet. *Chemical Senses*, *25*(6), 729–737. https://doi.org/10.1093/chemse/25.6.729

Schaffer, H. R. (2006). *Key concepts in developmental psychology*. London: Sage Publications.

Schmidt, N. B., Joiner, T. E., Young, J. E., & Telch, M. J. (1995). The schema questionnaire: Investigation of psychometric properties and the hierarchical structure of a measure of maladaptive schemas. *Cognitive Therapy and Research*, *19*(3), 295–321. https://doi.org/10.1007/BF02230402

Schmitt, D. P., & Allik, J. (2005). Simultaneous administration of the Rosenberg Self-Esteem Scale in 53 nations: exploring the universal and culture-specific features of global self-esteem. *Journal of Personality and Social Psychology*, *89*(4), 623-642.

Schoen, S. A., Miller, L. J., & Flanagan, J. (2018). A Retrospective Pre-Post Treatment Study of Occupational Therapy Intervention for Children with Sensory Processing Challenges. *The Open Journal of Occupational Therapy*, *6*(1), 1-16. https://doi.org/10.15453/2168-6408.1367

Schoen, S. A., Miller, L. J., & Green, K. E. (2008). Pilot study of the sensory over-responsivity scales: Assessment and inventory. *American Journal of Occupational Therapy*, *62*(4), 393–406. https://doi.org/10.5014/ajot.62.4.393

Sealy, Y. M. (2010). Parents' Food Choices: Obesity Among Minority Parents and Children. *Journal of Community Health Nursing*, *27*(1), 1–11. https://doi.org/10.1080/07370010903466072

Shah, R., & Waller, G. (2000). Parental style and vulnerability to depression: The role of core beliefs. *The Journal of Nervous and Mental Disease*, *188*(1), 19–25.

Shea, T. L., Tennant, A., & Pallant, J. F. (2009). Rasch model analysis of the Depression, Anxiety and Stress Scales (DASS). *BMC Psychiatry*, *9*(1), 21-31.

Sherry, B., McDivitt, J., Birch, L. L., Cook, F. H., Sanders, S., Prish, J. L., … Scanlon, K. S. (2004). Attitudes, practices, and concerns about child feeding and child weight status among socioeconomically diverse white, Hispanic, and African-American mothers. *Journal of the American Dietetic Association*, *104*(2), 215–221. https://doi.org/10.1016/j.jada.2003.11.012

Shim, J. E., Kim, J., & Mathai, R. A. (2011). Associations of Infant Feeding Practices and Picky Eating Behaviors of Preschool Children. *Journal of the American Dietetic Association*, *111*(9), 1363–1368. https://doi.org/10.1016/j.jada.2011.06.410

Shiner, R. L., Buss, K. A., Mcclowry, S. G., Putnam, S. P., Saudino, K. J., & Zentner, M. (2012). What Is Temperament Now? Assessing Progress Temperament Research on the Twenty-Fifth Anniversary of Goldsmith et al. *Child Development Perspectives*, *6*(4), 436–444. https://doi.org/10.1111/j.1750-8606.2012.00254.x

Shula, P., Haim, S., Avraham, S., & Marsha, K. (2008). Somatosensory functioning in children with attention deficit hyperactivity disorder. *Developmental Medicine & Child Neurology*, *39*(7), 464–468. https://doi.org/10.1111/j.1469-8749.1997.tb07466.x

Sinclair, S.J., Siefert, C.J., Slavin-Mulford, J.M., Stein, M.B., Renna, M., & Blais, M.A. (2012). Psychometric evaluation and normative data for depression, anxiety and stress scales-21 (DASS-21) in a non-clinical sample of US adults. *Evaluation & The Health Professions, 35 (3), 259-279*

Siper, P. M., Kolevzon, A., Wang, A. T., Buxbaum, J. D., & Tavassoli, T. (2017). A clinician-administered observation and corresponding caregiver interview capturing DSM-5 sensory reactivity symptoms in children with ASD. *Autism Research*, *10*(6), 1133–1140. https://doi.org/10.1002/aur.1750

Skinner, B. F. (1938). *The Behaviour of Organisms: An Experimental Analysis*. New York: Appleton-Century.

Skinner, J. D., Carruth, B. R., Bounds, W., & Ziegler, P. J. (2002). Children's food preferences: A longitudinal analysis. *Journal of the American Dietetic Association*, Vol. 102, pp. 1638–1647. https://doi.org/10.1016/S0002-8223(02)90349-4

Skinner, J. D., Carruth, B. R., Bounds, W., Ziegler, P., & Reidy, K. (2002). Do Food-Related Experiences in the First 2 Years of Life Predict Dietary Variety in School-Aged Children? *Journal of Nutrition Education and Behavior*, *34*(6), 310–315. https://doi.org/10.1016/S1499-4046(06)60113-9

Skouteris, H., McCabe, M., Ricciardelli, L. A., Milgrom, J., Baur, L. A., Aksan, N., & Dell'Aquila, D. (2012). Parent-child interactions and obesity prevention: a systematic review of the literature. *Early Child Development and Care*, *182*(2), 153–174. https://doi.org/10.1080/03004430.2010.548606

Sleddens, E. F., Kremers, S. P., & Thijs, C. (2008). The children's eating behaviour questionnaire: factorial validity and association with Body Mass Index in Dutch children aged 6-7. *The International Journal of Behavioral Nutrition and Physical Activity*, *5*, (49), 1-9. https://doi.org/10.1186/1479-5868-5-49

Smink, F. R. E., van Hoeken, D., & Hoek, H. W. (2012). Epidemiology of Eating Disorders: Incidence, Prevalence and Mortality Rates. *Current Psychiatry Reports*, *14*(4), 406–414. https://doi.org/10.1007/s11920-012-0282-y

Smith, A. M., Roux, S., Naidoo, N. T., & Venter, D. J. L. (2005). Food choices of tactile defensive children. *Nutrition*, *21*(1), 14–19. https://doi.org/10.1016/j.nut.2004.09.004

Stansbury, K., Haley, D. W., Lee, J., & Brophy-Herb, H. E. E. (2012). Adult Caregivers' Behavioral Responses to Child Noncompliance in Public Settings: Gender Differences and the Role of Positive and Negative Touch. *Behavior and Social Issues*, *21*, 80–114. https://doi.org/10.5210/bsi.v21i0.2979

Stark, L. J., Collins, F. L., Osnes, P. G., & Stokes, T. F. (1986). Using reinforcement and cueing to increase healthy snack food choices in preschoolers. *Journal of Applied Behavior Analysis*, *19*(4), 1308086. https://doi.org/10.1901/jaba.1986.19-367

Stein, A., Woolley, H., Murray, L., Cooper, P., Cooper, S., Noble, F., … Fairburn, C. G. (2001). Influence of psychiatric disorder on the controlling behaviour of mothers with 1-year-old infants: A study of women with maternal eating disorder, postnatal depression and a healthy comparison group. *The British Journal of Psychiatry*, *179*(2), 157–162.

Steiner, J. E. (1979). Human Facial Expressions in Response to Taste and Smell Stimulation. *Advances in Child Development and Behavior*, *13*, 257–295. https://doi.org/10.1016/S0065-2407(08)60349-3

Steinsbekk, S., Bonneville-Roussy, A., Fildes, A., Llewellyn, C. H., & Wichstrøm, L. (2017). Child and parent predictors of picky eating from preschool to school age. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 87. https://doi.org/10.1186/s12966-017-0542-7

Steinsbekk, S., Hamre Sveen, T., Fildes, A., Llewellyn, C., & Wichstrøm, L. (2017). Screening for pickiness -- a validation study. *International Journal of Behavioral Nutrition & Physical Activity*, *14*, 1–4. https://doi.org/10.1186/s12966-016-0458-7

Stifter, C.A., Willoughby, M.T., & Towe-Goodman, N. (2008). Agree or agree to disagree? Assessing the convergence between parents and observer on infant temperament. *Infant and Child Development, 17, 407-426. https://doi.org/10.1002/icd.584*

Stopa, L., Thorne, P., Waters, A., & Preston, J. (2001). Are the short and long forms of the Young Schema Questionnaire comparable and how well does each version predict psychopathology scores? *Journal of Cognitive Psychotherapy*, *15*(3), 253-261.

Sullivan, S. A., & Birch, L. L. (1990). Pass the sugar, pass the salt: Experience dictates preference. *Developmental Psychology*, *26*(4), 546-551.

Svensson, V., Lundborg, L., Cao, Y., Nowicka, P., Marcus, C., & Sobko, T. (2011). Obesity related eating behaviour patterns in Swedish preschool children and association with age, gender, relative weight and parental weight - factorial validation of the Children ' s Eating Behaviour Questionnaire. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 134. https://doi.org/10.1186/1479-5868-8-134

Szczesniak, A. S. (2002). Texture is a sensory property. *Food Quality and Preference*, *13*(4), 215–225. https://doi.org/10.1016/S0950-3293(01)00039-8

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*. Boston, Massachusetts: Allyn & Bacon/Pearson Education.

Tan, C. C., & Holub, S. C. (2011). Children's self-regulation in eating: Associations with inhibitory control and parents' feeding behavior. *Journal of Pediatric Psychology*, *36*(3), 340–345. https://doi.org/10.1093/jpepsy/jsq089

Tavassoli, T., Miller, L. J., Schoen, S. A., Jo Brout, J., Sullivan, J., & Baron-Cohen, S. (2018). Sensory reactivity, empathizing and systemizing in autism spectrum conditions and sensory processing disorder. *Developmental Cognitive Neuroscience*, *29*, 72–77. https://doi.org/10.1016/j.dcn.2017.05.005

Tepper, B. J. (1998). 6-n-Propylthiouracil: A Genetic Marker for Taste, with Implications for Food Preference and Dietary Habits. *The American Journal of Human Genetics*, *63*(5), 1271–1276. https://doi.org/10.1086/302124

Teti, D.M. & Gelfund, D.M. (1991). Behavioural competence among mothers of infants in the first year: the mediational role of maternal self-efficacy. *Child Development, 62 (5), 918-929. https://doi.org/10.1111/j.1467-8624.1991.tb01580.*

Tharner, A., Jansen, P. W., Kiefte-de Jong, J. C., Moll, H. A., Hofman, A., Jaddoe, V. W. V., … Franco, O. H. (2015). Bidirectional Associations between Fussy Eating and Functional Constipation in Preschool Children. *The Journal of Pediatrics*, *166*(1), 91-96. https://doi.org/10.1016/j.jpeds.2014.09.028

Tharner, A., Jansen, P. W., Kiefte-de Jong, J. C., Moll, H. a, van der Ende, J., Jaddoe, V. W. V, … Franco, O. H. (2014). Toward an operative diagnosis of fussy/picky eating: a latent profile approach in a population-based cohort. *The International Journal of Behavioral Nutrition and Physical Activity*, *11*(1), 14. https://doi.org/10.1186/1479-5868-11-14

Thomas, A., & Chess, S. (1977). Temperament and development. In *Temperament and development.* Oxford, England: Brunner/Mazel.

Thomas, A., & Chess, S. (1986). The New York longitudinal study: From infancy to early adult life. In Plomin, R. & Dunn, J. (Eds.), *The study of temperament: Changes, continuities, and challenges (pp. 39-52), Hilldale, NJ: Erlbaum*.

Timimi, S., Douglas, J., & Tsiftsopoulou, K. (1997). Selective eaters: a retrospective case note study. *Child: Care, Health and Development*, *23*(3), 265–278.

Tomchek, S. D., & Dunn, W. (2007). Sensory processing in children with and without autism: a comparative study using the short sensory profile. *American Journal of Occupational Therapy*, *61*(2), 190–200.

Townsend, N. & Foster, C. (2013). Developing and applying a socio-ecological model to the promotion of healthy eating in the school. *Public Health Nutrition, 16 (6), 1101-1108*

Trofholz, A. C., Schulte, A. K., & Berge, J. M. (2017). How parents describe picky eating and its impact on family meals: A qualitative analysis. *Appetite*, *110*, 36–43. https://doi.org/10.1016/j.appet.2016.11.027

Turnbull, B., & Matisoo-smith, E. (2002). Taste sensitivity to 6- n -propylthiouracil predicts acceptance of. *The American Journal of Clinical Nutrition*, *76*, 1101–1105.

US Department of Agriculture, US Department of Health and Human Services. *Nutrition and your Health: Dietary Guidelines for Americans.* 5th ed. Washington, DC: US Government Printing Office; 2000 van den Berg, M. M., Benninga, M. A., & Di Lorenzo, C. (2006). Epidemiology of Childhood Constipation: A Systematic Review. *The American Journal Of Gastroenterology*, *101*, 2401-2409. http://dx.doi.org/10.1111/j.1572-0241.2006.00771.x

van der Horst, K., Eldridge, A., Deming, D., & Reidy, K. (2014). Caregivers' perceptions about picky eating: associations with texture acceptance and food intake (379.3). *The FASEB Journal*, *28*(1), 373–379.

Van Der Horst, K., & Sleddens, E. F. C. (2017). Parenting styles, feeding styles and foodrelated parenting practices in relation to toddlers' eating styles: A cluster-analytic approach. *PLoS ONE, 12 (5)*, 1-16. https://doi.org/10.1371/journal.pone.0178149

Van Tine, M. L., McNicholas, F., Safer, D. L., & Agras, W. S. (2017). Follow-up of selective eaters from childhood to adulthood. *Eating Behaviors*, *26*, 61–65. https://doi.org/10.1016/j.eatbeh.2017.01.003

Vemeer, H.J., & Van Ijzendoorn, M.H., (2006). Children's elevated cortisol levels at daycare: A review and meta-analysis. *Early Childhood Research Quarterly, 21, 390-401.*

Ventura, A. K., & Birch, L. L. (2008). Does parenting affect children's eating and weight status? *International Journal of Behavioral Nutrition and Physical Activity*, *5*(1), 15-27.

Ventura, B. (2008). Does parenting affect children's eating and weight status. *International Journal of Behavioral Nutrition and Physical Activity*, *4*, 61–71. https://doi.org/10.1186/1479-Received

Vereecken, C. A., Keukelier, E., & Maes, L. (2004). Influence of mother's educational level on food parenting practices and food habits of young children. *Appetite*, *43*(1), 93–103. https://doi.org/10.1016/J.APPET.2004.04.002

Verhoeven, D. T. H., Goldbohm, R. A., Poppel, G. Van, & Verhagen, H. (1996). *Epidemiological studies on brassica vegetables and cancer Epidemiological Studies on Brassica Vegetables and Cancer Risk*. *5*, 733–748.

Volger, S., Sheng, X., Tong, L. M., Zhao, D., Fan, T., Zhang, F., … Yao, M. (2017). Nutrient intake and dietary patterns in children 2.5-5 years of age with picky eating behaviours and low weight-for-height. *Asia Pacific Journal of Clinical Nutrition*, *26*(1), 104–109. https://doi.org/10.6133/apjcn.102015.02

Waller, G., Meyer, C., & Ohanian, V. (2001). Psychometric properties of the long and short versions of the Young Schema Questionnaire: Core beliefs among bulimic and comparison women. *Cognitive Therapy and Research*, *25*(2), 137–147.

Waller, G., Ohanian, V., Meyer, C., & Osman, S. (2000). Cognitive content among bulimic women: The role of core beliefs. *International Journal of Eating Disorders*, *28*(2), 235–241. https://doi.org/10.1002/1098-108X(200009)28:2<235::AID-EAT15>3.0.CO;2-1

Waller, G., Shah, R., Ohanian, V., & Elliott, P. (2001). Core beliefs in bulimia nervosa and depression: the discriminant validity of Young's Schema Questionnaire.*Behaviour Therapy, 32 (1), 139-153.* https://doi.org/10.1016/S0005-7894(01)80049-6

Wardle, J, Guthrie, C. A., Sanderson, S., & Rapoport, L. (2001). Development of the Children's Eating Behaviour Questionnaire. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *42*(7), 963–970. https://doi.org/10.1111/1469-7610.00792

Wardle, J, Herrera, M.-L., Cooke, L., & Gibson, E. L. (2003). Modifying children's food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable. *European Journal of Clinical Nutrition*, *57*(2), 341–348. https://doi.org/10.1038/sj.ejcn.1601541

Wardle, J., Carnell, S., & Cooke, L. (2005). Parental control over feeding and children's fruit and vegetable intake: How are they related? *Journal of the American Dietetic Association*, *105*(2), 227–232. https://doi.org/10.1016/j.jada.2004.11.006

Wardle, J., Guthrie, C., Sanderson, S., Birch, L., & Plomin, R. (2001). Food and activity preferences in children of lean and obese parents. *International Journal of Obesity*, *25*(7), 971.

Webber, L., Hill, C., Cooke, L., Carnell, S., & Wardle, J. (2010). Associations between child weight and maternal feeding styles are mediated by maternal perceptions and concerns. *European Journal of Clinical Nutrition*, *64*(3), 259–265. https://doi.org/10.1038/ejcn.2009.146

Webber, L, Hill, C., Saxton, J., Van Jaarsveld, C. H. M., & Wardle, J. (2009). Eating behaviour and weight in children. *International Journal of Obesity*, *33*(1), 21–28. https://doi.org/10.1038/ijo.2008.219

Webber, L., Cooke, L., Hill, C., & Wardle, J. (2010). Associations between children's appetitive traits and maternal feeding practices. *Journal of the American Dietetic Association*, *110*(11), 1718–1722. https://doi.org/10.1016/j.jada.2010.08.007

Wehrly, S. E., Bonilla, C., Perez, M., & Liew, J. (2014). Controlling parental feeding practices and child body composition in ethnically and economically diverse preschool children. *Appetite*, *73*, 163–171.

Weinraub, M., & Wolf, B. M. (1983). Effects of stress and social supports on mother-child interactions in single-and two-parent families. *Child Development*, 1297–1311.

Welburn, K., Coristine, M., Dagg, P., Pontefract, A., & Jordan, S. (2002). The Schema Questionnaire—Short Form: Factor analysis and relationship between schemas and symptoms. *Cognitive Therapy and Research*, *26*(4), 519–530.

Welsh, E. M., French, S. A., & Wall, M. (2011). Examining the Relationship Between Family Meal Frequency and Individual Dietary Intake: Does Family Cohesion Play a Role? *Journal of Nutrition Education and Behavior*, *43*(4), 229–235. https://doi.org/10.1016/j.jneb.2010.03.009

Wertheim, E. H., Mee, V., & Paxton, S. J. (1999). Relationship s among adolescent girls' eating behaviours and their parents' weight-related attitudes and behaviours. *Sex Roles*, *41*(314), 169–187. https://doi.org/10.1023/A:1018850111450

Werthmann, J., Jansen, A., Havermans, R., Nederkoorn, C., Kremers, S., & Roefs, A. (2015). Bits and pieces. Food texture influences food acceptance in young children. *Appetite*, *84*, 181–187. https://doi.org/10.1016/j.appet.2014.09.025

Whelan, E., & Cooper, P. J. (2000). The association between childhood feeding problems and maternal eating disorder: a community study. *Psychological*

Medicine, *30*(1), 69–77. https://doi.org/10.1017/S0033291799001543
Whiteside-Mansell, L., & Corwyn, R. F. (2003). Mean and covariance structures analyses: An examination of the Rosenberg Self-Esteem Scale among adolescents and adults. *Educational and Psychological Measurement*, *63*(1), 163–173.
WHO. (2004). World Health Organisation. *Fruit and vegetables for health: Report of a Joint FAO/WHO* Workshop. Kobe, Japan: WHO.
WHO. (2013). World Health Organisation. *Breast Cancer*: https://www.who.int/cancer/prevention/diagnosis-screening/breast-cancer/en/ (assessed 15/9/16)
WHO. (2015). World Health Organisation. *Cardiovascular diseases, Fact sheet:* https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) (assessed 15/9/16)
WHO. (2016). World Health Organisation. *Breastfeeding*: https://www.who.int/topics/breastfeeding/en (assessed 11/10/16)
WHO. (2016). World Health Organisation. *Complimentary feeding*: https://www.who.int/nutrition/topics/complementary_feeding/en (assessed 11/10/16
Willett, W. (2001). Commentary: dietary diaries versus food frequency questionnaires—a case of undigestible data. *International Journal of Epidemiology*, *30*(2), 317–319.
Willis, T. A., George, J., Hunt, C., Roberts, K. P. J., Evans, C. E. L., Brown, R. E., & Rudolf, M. C. J. (2014). Combating child obesity: Impact of HENRY on parenting and family lifestyle. *Pediatric Obesity*, *9*(5), 339–350. https://doi.org/10.1111/j.2047-6310.2013.00183.x
World Cancer Research Fund/American Institute for Cancer Research (2009) *Policy and Action for Cancer Prevention. Food, Nutrition, and Physical Activity*: A Global Perspective. Washington, DC: AICR
Wright, C. M., Parkinson, K. N., Shipton, D., & Drewett, R. F. (2007). How do toddler eating problems relate to their eating behavior, food preferences, and growth? *Pediatrics*, *120*(4), e1069-75. https://doi.org/10.1542/peds.2006-2961
Xu, Y., Wang, L., He, J., Bi, Y., Li, M., Wang, T., … Ning, G. (2013). Prevalence and control of diabetes in Chinese adults. *JAMA - Journal of the American Medical Association*, *310*(9), 948–958. https://doi.org/10.1001/jama.2013.168118
Young, B., & Drewett, R. (2000). Eating behaviour and its variability in 1-year-old children. *Appetite*, *35*(2), 171–177. https://doi.org/10.1006/appe.2000.0346
Young, J E. (1998). *Young Schema Questionnaire–short form (YSQ-S)(On-line).* New York: Cognitive Therapy Centre.
Young, J. E. (1994). *Cognitive therapy for personality disorders: A Schema Focuses Approach. Sarasota, Florida*: Professional Resource Press.
Young, J. E, & Brown, G. (1994). Young schema questionnaire (2nd ed). In Young, J.E. (Ed.), *Cognitive Therapy for Personality Disorders: A Schema-Focused Approach*, pp. 63–76. Sarasota, Florida: Professional Resource Press.
Youssef, N. N., Langseder, A. L., Verga, B. J., Mones, R. L., & Rosh, J. R. (2005). Chronic childhood constipation is associated with impaired quality of life: A case-controlled study. *Journal of Pediatric Gastroenterology and Nutrition*, *41*(1), 56–

60. https://doi.org/10.1097/01.mpg.0000167500.34236.6a
Zajonc R. B. (1968). Attitudinal Effects of Mere Exposure. *Journal of Personality and Social Psychology*, *9*(2 PART 2), 1–27. https://doi.org/10.1037/h0025848
Zentner, M., Bates, J. E., & Article, R. (2008). Child Temperament: An Integrative Review of Concepts, Research Programs, and Measures. *International Journal of Developmental Science*, *2*(1), 7–37. https://doi.org/10.3233/DEV-2008-21203
Zerwas, S., Von Holle, A., Torgensen, L., Reichborn- Kjennerud, T., Stoltenberg, C., & Bulik, C.M. (2012). Maternal eating disorders and infant temperamnet: Findings from the Norwegian mother and child cohort study. I*nternational Journal of Eating Disorders, 45 (4), 546-555. https:// doi:10.1002/eat.20983.*
Zickgraf, H. F., & Elkins, A. (2018). Sensory sensitivity mediates the relationship between anxiety and picky eating in children/ adolescents ages 8–17, and in college undergraduates: A replication and age-upward extension. *Appetite*, *128*(April), 333–339. https://doi.org/10.1016/j.appet.2018.06.023
Zickgraf, H. F., & Schepps, K. (2016). Fruit and vegetable intake and dietary variety in adult picky eaters. *Food Quality and Preference*, *54*, 39–50. https://doi.org/10.1016/j.foodqual.2016.06.012
Zilanawala, A., Davis-Kean, P., Nazroo, J., Sacker, A., Simonton, S., & Kelly, Y.. (2015). Race/ethnic disparities in early childhood BMI, obesity and overweight in the United Kingdom and United States. *International Journal of Ob*esity, 39, 520-529.
Zucker, N., Copeland, W., Franz, L., Carpenter, K., Keeling, L., Angold, A., & Egger, H. (2015). Psychological and psychosocial impairment in preschoolers with selective eating. *Pediatrics*, 136 (3), 582-590.

6.6 Appendices

Appendix A: Emotionality Activity Sociability Scale (EAS; Buss & Plomin, 1984)

Please read each statement and rate each of the items for your child on a scale of 1 (not characteristic or typical of your child) to 5 (very characteristic or typical of your child).

	1	2	3	4	5
1. My Child tends to be shy.	☐	☐	☐	☐	☐
2. My Child cries easily.	☐	☐	☐	☐	☐
3. My Child likes to be with people.	☐	☐	☐	☐	☐
4. My Child is always on the go.	☐	☐	☐	☐	☐
5. My Child prefers playing with others rather than alone.	☐	☐	☐	☐	☐
6. My Child tends to be somewhat emotional.	☐	☐	☐	☐	☐
7. When my child moves about, he usually moves slowly.	☐	☐	☐	☐	☐
8. My Child makes friends easily.	☐	☐	☐	☐	☐
9. My Child is off and running as soon as he wakes up in the morning.	☐	☐	☐	☐	☐
10. My Child finds people more stimulating than anything else.	☐	☐	☐	☐	☐
11. My Child often fusses and cries.	☐	☐	☐	☐	☐

12. My Child is very sociable.	☐	☐	☐	☐	☐
13. My Child is very energetic.	☐	☐	☐	☐	☐
14. My Child takes a long time to warm up to strangers.	☐	☐	☐	☐	☐
15. My Child gets upset easily.	☐	☐	☐	☐	☐
16. My Child is somewhat of a loner.	☐	☐	☐	☐	☐
17. My Child prefers quiet, inactive games to more active ones.	☐	☐	☐	☐	☐
18. When alone, my child feels isolated.	☐	☐	☐	☐	☐
19. My Child reacts intensely when upset.	☐	☐	☐	☐	☐
20. My Child is friendly with strangers.	☐	☐	☐	☐	☐

Scoring of the EAS

Shyness = 1, 8, 12, 14, 20

Emotionality = 2, 6, 11, 15, 19

Sociability = 3, 5, 10, 16, 18

Activity = 4, 7, 9, 13, 17

Reversed items

Questions 7, 8, 12, 16, 17 and 20 are reversed scored by setting 5=1 etc

To obtain each subscale score, sum the item scores & divide by number of answers in each subscale to calculate a mean for each of the four subscales.

Appendix B: Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995).

Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statemen applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time o any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Scoring of the DASS

Sum scores to obtain each subscale score

Depression: 3, 5, 10, 13, 16, 17, 21

Anxiety: 2, 4, 7, 9, 15, 19, 20

Stress: 1, 6, 8, 11, 12, 14, 18

	Depression	**Anxiety**	**Stress**
Normal	0 - 4	0 - 3	0 - 7
Mild	5 - 6	4 - 5	8 - 9
Moderate	7 -10	6 - 7	10 -12
Severe	11 -13	8 - 9	13 -17
Extremely severe	14+	10+	17+

Appendix C: Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965)

Instructions

Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

	STATEMENT	Strongly Agree	Agree	Disa-gree	Strongly Dis-agree
1.	I feel that I am a person of worth, at least on an equal plane with others.	○	○	○	○
2.	I feel that I have a number of good quali-ties.	○	○	○	○
3.	All in all, I am inclined to feel that I am a failure.	○	○	○	○
4.	I am able to do things as well as most other people.	○	○	○	○
5.	I feel I do not have much to be proud of.	○	○	○	○
6.	I take a positive attitude toward myself.	○	○	○	○
7.	On the whole, I am satisfied with myself.	○	○	○	○
8.	I wish I could have more respect for my-self.	○	○	○	○
9.	I certainly feel useless at times.	○	○	○	○
10.	At times I think I am no good at all.	○	○	○	○

Scoring of the RSES

The 5 positively worded statements are scored on a 4-point scale where 0= Strongly Disagree, 1 = Disagree, 2 = Agree and 3= Strongly Agree.

The 5 negatively worded statements are reversed scored so that 0= Strongly Agree, 1 = Agree, 2= Disagree and 3= Strongly Disagree

A global self-esteem score is calculated by summing all scores, with scores ranging along a continuum from low self-esteem to high self- esteem

Appendix D: Young Schema Questionnaire (YSQ; Young, 1998)

Name ____Date__________

INSTRUCTIONS:

Listed below are statements that a person might use to describe himself or herself. Please read each statement and decide how well it describes you. When there you are not sure, base your answer on what you emotionally **feel**, not on what you **think** to be true. Choose the **highest rating from 1 to 6** that describes you and write the number in the space before the statement.

RATING SCALE:

1 = Completely untrue of me

2 = Mostly untrue of me

3 = Slightly more true than untrue

4 = Moderately true of me

5 = Mostly true of me

6 = Describes me perfectly

1.______ Most of the time, I haven't had someone to nurture me, share him/herself with me, or care deeply about everything that happens to me.

2. ______In general, people have not been there to give me warmth, holding, and affection.

3. ______For much of my life, I haven't felt that I am special to someone.

4. ______For the most part, I have not had someone who really listens to me, understands me, or is tuned into my true needs and feelings.

5. ______I have rarely had a strong person to give me sound advice or direction when I'm not sure what to do.

*ed

6.______I find myself clinging to people I'm close to, because I'm afraid they'll leave me.

7.______I need other people so much that I worry about losing them.

8.______I worry that people I feel close to will leave me or abandon me.

9.______When I feel someone, I care for pulling away from me, I get desperate.

10._____Sometimes I am so worried about people leaving me that I drive them away.

*ab

11. _____ No man/woman I desire could love me one he/she saw my defects.

12. _____ No one I desire would want to stay close to me if he/she knew the real me.

13. _____ I'm unworthy of the love, attention, and respect of others.

14. _____ I feel that I'm not lovable.

15. _____ I am too unacceptable in very basic ways to reveal myself to other people.

*ds

16. _____ Almost nothing I do at work (or school) is as good as other people can do.

17. _____ I'm incompetent when it comes to achievement.

18. _____ Most other people are more capable than I am in areas of work and achievement.

19. _____ I'm not as talented as most people are at their work.

20. _____ I'm not as intelligent as most people when it comes to work (or school).

*fa

21. _____ I do not feel capable of getting by on my own in everyday life.

22. _____ I think of myself as a dependent person, when it comes to everyday functioning.

23. _____ I lack common sense.

24. _____ My judgment cannot be relied upon in everyday situations.

25. _____ I don't feel confident about my ability to solve everyday problems that come up.

*di

26. _____I have not been able to separate myself from my parent(s), the way other people my age seem to.

27. _____My parent(s) and I tend to be over involved in each other's lives and problems.

28. _____It is very difficult for my parent(s) and me to keep intimate details from each other, without feeling betrayed or guilty.

29. _____ I often feel as if my parent(s) are living through me--I don't have a life of my own.

30. _____I often feel that I do not have a separate identity from my parent(s) or partner.

*em

31. _____ I think that if I do what I want, I'm only asking for trouble.

32. _____ I feel that I have no choice but to give in to other people's wishes, or else they will retaliate or reject me in some way.

33. _____ In relationships, I let the other person have the upper hand.

34. _____ I've always let others make choices for me, so I really don't know what I want for myself.

35. _____ I have a lot of trouble demanding that my rights be respected and that my feelings be taken into account.

*sb

Scoring of the YSQ

Sum scores to obtain each subscale score

Appendix E: Child Eating Behaviour Questionnaire (CEBQ; Wardle et al., 2001)

Please read the following statements and tick the boxes most appropriate to your child's eating behaviour.

	Never	Rarely	Some -times	Often	Always	
1. My child loves food	☐	☐	☐	☐	☐	EF
2. My child eats more when worried	☐	☐	☐	☐	☐	EOE
3. My child has a big appetite	☐	☐	☐	☐	☐	SR*
4. My child finishes his/her meal quickly	☐	☐	☐	☐	☐	SE*
5. My child is interested in food	☐	☐	☐	☐	☐	EF
6. My child is always asking for a drink	☐	☐	☐	☐	☐	DD
7. My child refuses new foods at first	☐	☐	☐	☐	☐	FF
8. My child eats slowly	☐	☐	☐	☐	☐	SE
9. My child eats less when angry	☐	☐	☐	☐	☐	EUE
10. My child enjoys tasting new foods	☐	☐	☐	☐	☐	FF*
11. My child eats less when s/he is tired	☐	☐	☐	☐	☐	EUE
12. My child is always asking for food	☐	☐	☐	☐	☐	FR
13. My child eats more when annoyed	☐	☐	☐	☐	☐	EOE
14. If allowed to, my child would eat too much	☐	☐	☐	☐	☐	FR
15. My child eats more when anxious	☐	☐	☐	☐	☐	EOE
	☐	☐	☐	☐	☐	FF*

16. My child enjoys a wide variety of foods						
17. My child leaves food on his/her plate at the end of a meal	☐	☐	☐	☐	☐	SR
18. My child takes more than 30 minutes to finish a meal	☐	☐	☐	☐	☐	SE

	Never	Rarely	Some -times	Often	Always	
19. Given the choice, my child would eat most of the time	☐	☐	☐	☐	☐	FR
20. My child looks forward to mealtimes	☐	☐	☐	☐	☐	EF
21. My child gets full before his/her meal is finished	☐	☐	☐	☐	☐	SR
22. My child enjoys eating	☐	☐	☐	☐	☐	EF
23. My child eats more when she is happy	☐	☐	☐	☐	☐	EUE
24. My child is difficult to please with meals	☐	☐	☐	☐	☐	FF
25. My child eats less when upset	☐	☐	☐	☐	☐	EUE
26. My child gets full up easily	☐	☐	☐	☐	☐	SR
27. My child eats more when s/he has nothing else to do	☐	☐	☐	☐	☐	EOE
28. Even if my child is full up s/he finds room to eat his/her favourite food	☐	☐	☐	☐	☐	FR
29. If given the chance, my child would drink continuously throughout the day	☐	☐	☐	☐	☐	DD
30. My child cannot eat a meal if s/he has had a snack just before	☐	☐	☐	☐	☐	SR

31. If given the chance, my child would always be having a drink	☐	☐	☐	☐	☐	DD
32. My child is interested in tasting food s/he hasn't tasted before	☐	☐	☐	☐	☐	FF*
33. My child decides that s/he doesn't like a food, even without tasting it	☐	☐	☐	☐	☐	FF
34. If given the chance, my child would always have food in his/her mouth	☐	☐	☐	☐	☐	FR
35. My child eats more and more slowly during the course of a meal	☐	☐	☐	☐	☐	SE

SCORING OF THE CEBQ

To obtain each subscale score, add up the total of the items for each subscale and divide by the number of items.

(Never=1, Rarely=2, Sometimes=3, Often=4, Always=5)

Food responsiveness	=	item mean FR
Emotional over-eating	=	item mean EOE
Enjoyment of food	=	item mean EF
Desire to drink	=	item mean DD
Satiety responsiveness	=	item mean SR
Slowness in eating	=	item mean SE
Emotional under-eating	=	item mean EUE
Food fussiness	=	item mean FF

***Reversed items 3,4,10,16 and 32 by setting 5=1 et**

Appendix F: Sociodemographic Questionnaire – Study 1

1. Which category below indicates your age? (Please tick one)

   ☐ 25 years old or younger

   ☐26-30 years old

   ☐ 31-35 years old

   ☐36-40 years old

   ☐41-45 years old

   ☐46-50 years old

2. What is your gender?
   Male ☐

   Female☐

3. What is your ethnic group? (Please tick one)
   ☐White (English/Welsh. Scottish/ Northern Irish)

   ☐White (Irish)

   ☐White (Any other white background)

   ☐Black (Black Caribbean)

   ☐Black (Black African)

   ☐Black (Any other black background)

   ☐Mixed (Black Caribbean/White)

   ☐Mixed (Black African/White)

   ☐Mixed (Asian/White)

☐Mixed (Any other mixed background)

☐Asian (Indian)

☐Asian (Pakistani)

☐Asian (Bangladeshi)

☐Asian (Chinese)

☐Asian (Any other Asian background)

☐Other ethnic group (Arab)

☐Other ethnic group (Any other ethnic group)

4. What is your marital status? (Please tick one)

☐Single

☐Living together

☐Married

☐Divorced

☐Separated

☐Widowed

5. What is the highest level of education you have completed? (Please tick one)

☐Attended primary education

☐Completed primary education

☐Attended secondary education

☐Completed secondary education

☐Undergraduate degree

☐Post graduate degree

Appendix G – Online Advert – Study 1

Mothers of children aged 2-4 years needed to take part in a new study at the University of Reading

Mothers of children aged 2 – 4 years are needed to take part in a study interested in finding out why some children are fussy eaters and others are not. This information will help us find out what might trigger/cause fussy eating so that support for families affected by fussy eating can be targeted more effectively.

It doesn't matter if your child is a fussy eater or not as we are interested in mothers of both fussy and non-fussy eaters

If you are willing to help, please click the link below to fill in some online questionnaires, which will take no more than 45 minutes. Thank you for your time!

www.survey.bris.ac.uk/reading/fussyeating

If you would like more information or have any questions, feel free to get in touch by contacting

Dr Kate Harvey k.n.harvey@reading.ac.uk or 0118 378 7524

Stella Rendall S.Rendall@pgr.reading.ac.uk

Appendix H: Leaflets for Study 1

Fussy eating is the refusal of a lot of foods, both familiar and unfamiliar. It can result in poor nutrition and it can lead to stressful mealtimes for families. Here at the University of Reading we are interested in finding out why some children are fussy eaters and others are not. This information will help us find out what might trigger/cause fussy eating so that support for families affected by fussy eating can be targeted more effectively.

Who can take part?

Any parent of a child aged 2 to 4 years, whether or not the child is a fussy eater.

What does taking part involve?

We would like you to fill in some online questionnaires, which will take no more than 45 minutes.

You can visit www.survey.bris.ac.uk/reading/fussyeating to fill in the questionnaire online. Alternatively if you prefer to fill in a paper version of the questionnaire, please email one of the team:

Dr Kate Harvey at k.n.harvey@reading.ac.uk or 0118 378 7524

Stella Rendall S.Rendall@pgr.reading.ac.uk

If you would like more information or have any questions, feel free to get in touch.

Appendix I: Contact Letter for Headteachers/Managers of Nurseries and Preschools – Study 1

School of Psychology and Clinical Language Sciences
University of Reading
Whiteknights.
Reading
RG6 6AL

Dear {Headteacher/Manager} {Date}

Fussy Eating Study

My name is Stella Rendall and I am a PhD student conducting research on child food fussy eating at the University of Reading. This research study will be investigating child and maternal characteristics that could be potential risk factors for the development of fussy eating. Findings from this study could help identify children most likely to become fussy eaters based on child and maternal factors and contribute to the development of interventions to address fussy eating.

I am writing to ask if you could help me with part of my research my distributing leaflets to mothers of children aged 2- 4 years. Taking part in this study is optional and all data will be anonymous and kept confidential which is stated in the participation information sheet.

If you are willing to distribute leaflets to mothers, please contact me by email s.rendall@pgr.reading.ac.uk. If you have any questions, please don't hesitate to contact me and I can provide a copy of the leaflet and participant information sheet for your reference.

Thank you for taking the time to read my letter and in anticipation for your help with my research study. I look forward to hearing from you.

Yours Sincerely,

Stella Rendall

Appendix J: Participant Information Sheet-Study 1

School of Psychology and Clinical Language Sciences.
University of Reading
Whiteknights.
Reading
RG6 6AL

Fussy eating is the refusal of a lot of foods, both familiar and unfamiliar. This can result in a diet that is not adequate and can lead to stressful mealtimes for families. Here at the University of Reading, we are interested in finding out why some children are fussy eaters whereas others are not. This information will help identify those who might be at risk for the development of fussy eating so that they can be prioritised for interventions aimed at supporting families affected by fussy eating.

We are looking for mothers of children aged 2-4 years to help with our research. As we are interested in the differences between fussy eaters and non-fussy eaters, everyone can take part, not just those who have children who are fussy eaters. If you can help with our research, we'd like to ask you to complete some questions about yourself and your child, which we anticipate should take no more than 30 minutes. Participating in the study is completely optional, and you are free to withdraw at any time. If during the study you decide you no longer want to take part, you can withdraw by closing your internet browser. Your responses on these questionnaires will be anonymous and kept confidential.

If you have any concerns or questions about this study, we'd be happy to talk to you or give you more information. Here are out contact details:

Supervisors:	Email:	Phone:
Dr Kate Harvey	k.n.harvey@reading.ac.uk	(0)118 378 7524
Dr Helen Dodd	h.f.dodd@reading.ac.uk	(0)118 378 5285
Investigator:		
Stella Rendall	S.Rendall@pgr.reading.ac.uk	

Appendix K: Consent form – Study 1

- I have read and understood the accompanying Participants Information Sheet.
- I have been given the opportunity to ask questions about the study and these have been answered to my satisfaction.
- I understand that all personal information will remain confidential to the Investigator and arrangements for the storage and eventual disposal of any identifiable material have been made clear to me.
- This application has been reviewed by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct.
- I understand that participation is entirely voluntary and that I have the right to withdraw from the project any time, and that this will be without detriment.

☐ By ticking this box, I agree to participate in the project investigating the role of maternal and child characteristics in predicting fussy eating.

Appendix L: Sociodemographic Questionnaire-Studies 2 & 3

1. How old is your child?

2. Is your child (please tick a box)

   Male ☐

   Female ☐

3. What is your age?

4. How would you describe your ethnicity? (Please tick one)

   ☐White (English/Welsh. Scottish/ Northern Irish)

   ☐White (Irish)

   ☐White (Any other white background)

   ☐Black (Black Caribbean)

   ☐Black (Black African)

   ☐Black (Any other black background)

   ☐Mixed (Black Caribbean/White)

   ☐Mixed (Black African/White)

   ☐Mixed (Asian/White)

   ☐Mixed (Any other mixed background)

   ☐Asian (Indian)

   ☐Asian (Pakistani)

   ☐Asian (Bangladeshi)

   ☐Asian (Chinese)

☐Asian (Any other Asian background)

☐Other ethnic group (Arab)

☐Other ethnic group (Any other ethnic group)

5. What is your marital status? (Please tick one)
   ☐Single

   ☐Living with spouse/ partner

   ☐Not living with spouse / partner

6. What is the highest level of education you have completed? (Please tick one)
   ☐Attended primary education

   ☐Completed primary education

   ☐Attended secondary education

   ☐Completed secondary education

   ☐Undergraduate degree

   ☐Post graduate degree

Appendix M: Studies 2 and 3 - Telephone Interview

Good Morning/afternoon, is that Mr/Mrs/Ms…………………………………………………….

Hello, my name is Stella and I am calling from the University of Reading as part of the Research and Development group. Do you remember, when you were in hospital having [name] you expressed an interest and willingness to be contacted for research studies.

A study has recently come up that your child's (name of child) age has been matched to. Have you got time for me to quickly tell you about the study?

If no: Is there a better time I could call? If parent expresses no desire to be contacted about the study again then no follow-up call will be made.

If yes: continue

The study involves observing children eat so we can see how children considered as fussy eaters differ from those considered as non-fussy eaters. The study will involve you completing a food checklist that will help identify foods that are familiar and unfamiliar to your child as well as foods that your child is likely to find appealing and unappealing. It will also involve completing a short questionnaire on fussy eating. We will then ask to arrange a home visit where your child will be video recorded eating a small meal made up of the foods that you have chosen

Is this a study you will be interested in taking part in?

If No: Thank you for your time.

If Yes:

That's great! Before we go any further, can I ask a few questions just to check if your child will be suitable for this study. Firstly, because most of the foods may contain nuts and dairy, I need to check if your child has been diagnosed with a nut allergy, as lactose intolerant or has any known food allergies. Secondly, as far as you know, is your child developing typically and meeting their milestones?

If Yes to first question/ No to second question:

Thanks for letting me know, unfortunately, we don't think this study will be suitable for your child as we can't guarantee that the foods we have selected to include in the study will be nut or dairy free. Thanks very much for your time and for offering to participate.

Thank you for letting me know about that. For this study, we are looking for children who are at a fairly typical stage for their age, so that our findings aren't influenced by their development. It sounds as if xxx might not be quite at that stage. Thanks very much for offering to get involved, and this won't necessarily mean they can't participate in the future studies with the infant panel.

If parent is unsure, ask for detail.

If I am unsure:

Thank you for letting me know about that. For this study, we are looking for children who are at a fairly typical stage for their age, so that our findings aren't influenced by their development. And based on what you've said, I'm not sure if xxx would be suitable. Would it be OK if I have a chat with my colleagues and get back to you?

If any parents express concern about their child's development, suggest they speak to health visitor or GP.

If No to first question/Yes to second question:

Great, if it's OK I'm going to send you an online link to an information sheet with more information about the study, a consent form and a food checklist. The checklist has instructions with it, but it will invite you to indicate whether your child would find each of the foods familiar/unfamiliar, and appealing/unappealing. It will take just a few minutes to complete. I will also send you a questionnaire about your child's eating which will take about 10 minutes to complete. Can I email these to you, or would you prefer me to post them? When you have completed these and returned them, I will contact you to arrange a convenient date and time for the home visit and to confirm what food items I will be bringing based on your responses. Will you prefer to be contacted by email or can I ring you on this number?

Thank you for your time and I will be in touch shortly

Appendix N: Parent Information Sheet- Studies 2 & 3

Investigator:

Stella Rendall S.Rendall@pgr.reading.ac.uk

Supervisors:

Dr Kate Harvey k.n.harvey@reading.ac.uk (0)118 378 7524

Dr Helen Dodd h.f.dodd@reading.ac.uk (0)118 378 5285

Information About the Study

Fussy eating is the frequent refusal of a lot of foods, both familiar and unfamiliar. It can result in poor nutrition and it can lead to stressful mealtimes for families. Here at the University of Reading, we are interested in finding out why some children are fussy eaters whereas others are not. This information will help us to identify children who might be at risk of becoming fussy eaters, so that support for families affected by fussy eating can be targeted more effectively.

We usually rely on parents' responses to questionnaires to determine whether a child is a fussy eater. However, we are not certain that the questionnaires we use always fully describe children's behaviour. To help us establish if they do, we are observing children eating a meal and comparing their behaviour to parents' questionnaire responses. We would be grateful if you and your child could help us with this research. It is important that we do this for the full range of children's behaviour, so you can participate whether or not your child is a fussy eater.

If you agree to participate we will first contact you by telephone and ask you to you to complete a brief questionnaire about your child's eating (emailed to you). We will also ask you to identify foods from a list (also emailed to you) that your child is likely to find familiar/unfamiliar and appealing/unappealing. The foods you identify will be used to create a meal for the next part of the study.

Following this conversation the researcher, Stella Rendall, will telephone and arrange to come and visit you and your child at home on a date convenient to you. We will ask you to select a meal, either lunch or tea, when it will be only you and your child. This will minimise the influence of other family members eating at the same time. We will ask you to not give your child any food or drink other than water for two hours before the meal so that they will be ready to eat something.

When Stella comes to visit, she will observe your child eating a small meal that comprises a mixture of familiar, familiar, appealing and unappealing food (based on the foods you identified). Stella will bring the food, along with instructions for preparation. Preparation will only take a few minutes as the food has been chose for its ease of preparation, for example heating soup or slicing bread. While you are preparing the food, Stella will get to know your child by inviting him/her to play a game or do some drawing. Once the meal is prepared, Stella will ask you to offer it to your child in the way you normally would. Your child is not under any pressure to eat any of the food or even stay and eat, we are simply observing what happens. Either you or your child can withdraw from the study at any time. When the meal is finished, Stella will weigh the food leftover so that we have an accurate record of how much your child ate. We expect this visit will last around one hour.

During the visit, Stella will use a video camera to record your child. The camera will be set-up and recording prior to the meal, while Stella is getting to know your child, so that your child becomes familiar with it. The camera will be turned off when the meal is finished.

Participation in the study is voluntary and either you or your child can stop at any time. All the information collected for this study will be strictly confidential. To ensure this we will use a confidential number known only to the investigators, data will be stored in password protected files and all contact details will be stored separately to data in files that are also password protected. Consent forms will be stored on a file and kept for 5 years after which they will be destroyed. Video recordings and questionnaire data will be on password protected digital files in the University of Reading Psychology Department and destroyed at the end of the study. This application has been reviewed by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct. All investigators on this project have had Disclosure and Baring Service checks and have been approved by the School to work with children.

If you have any concerns or questions about this study, please telephone or email and we will be happy to talk to you or give you more information. Thank you for your help.

<u>FAQs</u>

Q. What if my child doesn't like to food?
A. That's fine, he/she doesn't have to eat anything.

Q. What if my child won't sit for the meal?
A. That's fine, he/she doesn't have to stay for the meal.

Q. How long will the food take to prepare?
A. Just a few minutes.

Q. Is the food difficult to prepare?
A. No. It will involve heating soup, slicing bread, washing and preparing raw fruit/vegetables.

Q. How long will the visit take?
A. It depends on your child, but probably around one hour. However, you or your child can stop at any time.

Q. What if my child feels too shy to participate?
A. Stella will spend some time getting to know your child. She will invite them to play a game, or do some drawing. We hope this will mean your child feels comfortable with Stella around. During the meal Stella will simply be observing.

Q. How will the video-recordings be used?
A. The video-recordings will be used to assess your child's willingness to taste and/or eat each food. This would be difficult for Stella to accurately make notes on during the meal, so the video-recordings will help. The video-recordings are confidential, and will be stored securely. They will only be viewed by the research team, and they will be destroyed once the study has finished

Appendix O: Consent form- Studies 2 & 3

Investigator:

Stella Rendall S.Rendall@pgr.reading.ac.uk

Supervisors:

Dr Kate Harvey k.n.harvey@reading.ac.uk (0)118 378 7524

Dr Helen Dodd h.f.dodd@reading.ac.uk (0)118 378 5285

- I have seen and read a copy of the Information Sheet: ___________ (*please initial*)
- I have been given the opportunity to ask questions about the study and these have been answered to my satisfaction: __________ (*please initial*)
- I understand that all personal information will remain confidential to the Investigator and arrangements for the storage and eventual disposal of any identifiable material have been made clear to me: _______________ (*please initial*)
- I understand that our participation is voluntary: __________ (*please initial*)
- I understand that either my child, or me on my child's behalf, can withdraw at any time without having to give an explanation: __________ (*please initial*)
- I consent to my child participating: __________ (please initial)
- I consent to my child to be video-recorded: __________ (*please initial*)

I am happy to proceed with our participation.

Signature --

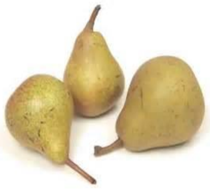
Name (in capitals) --

Child's Name (in capitals) ---

Appendix P: Food Checklist used in Studies 2 & 3

Below are names and images of foods which are expected to be familiar and unfamiliar to young children. Please tick one of the boxes which best describes how your child is likely to perceive each food.

Food Item	Familiar and appealing	Familiar and unappealing	Unfamiliar and appealing	Unfamiliar and unappealing
Beetroot soup 				
Petits Pois and ham soup 				
Lentil dahl soup 				
 **Grapes**				

 Carrots				
 Gooseberry				
Avocado 				
 Pear				
 Sweet corn				
 Walnut loaf				
 Granary bread				

Rye bread 				
Crème Caramel 				
Profiteroles 				
Pistachio icecream 				
Panna cotta 				
Pistachio flavoured macaroons 				

Custard tarts 				
Semi-skimmed milk 				

Of the above list of foods, is/ are there any you would be unwilling to give to your child as part of an observational research study. Please list the food(s) below and provide your reasons.

If you would like more information or have any questions, please email one of the team:

Dr Kate Harvey at k.n.harvey@reading.ac.uk
Dr Helen Dodd at h.f.dodd@reading.ac.uk
Stella Rendall at S.Rendall@pgr.reading.ac.uk

Appendix Q: Debrief- Studies 2 & 3

Participant Debrief

Many thanks for participating in this research, we really appreciate your participation. The results of this observational study will be compared to the responses on the fussy eating questionnaire to help establish its reliability.

If you are concerned about your child's eating behaviour and feel it would be helpful to speak to someone, you may wish to consider the options below:

Get in touch with your General Practitioner who will be able to offer support or arrange for your child to be seen by a specialist.

OR

Visit websites which offer support and advice to parents of fussy eaters. Some examples are provided below

www.nhs.uk/Conditions/pregnancy-and-baby/pages/fussy-eaters/aspx which offers tips and advice to parents of fussy eaters.

www.netmums.com which offers tips, recipes, support and advice from other mothers with fussy eating children.

Appendix R: Coding Scheme - Study 2

Meal duration.

This is coded as the **total time** from when the child is invited to come and eat through to when the child indicates that he/she has finished eating when asked by the parent.

Consumption of food.

This is coded as the **total number of times** the child consumes the presented food. Consuming food is coded as putting food in the mouth and swallowing it. Consuming is not coded as licking food or placing food in the mouth and spitting it out. **A count was made each time the child consumed food.**

Touching of food.

This is coded as the **total number of times** the child touches the presented food. Touching is coded as handling the presented food without licking, playing or consuming the food. Note if a child consumes the food immediately after touching this **is not** coded as touching but as consumption of food. **A count was made each time the child touched food without consuming it.**

Licking of food

This is coded as the **total number of times** the child licks the presented food. Touching the food and licking their finger is also coded as licking of food. Note if a child consumes the food immediately after licking this **is not** coded as licking but as consumption of food. Licking of food is only coded when the child licks the food but does not go on to consume it. **A count was made each time the child licked food without consuming it.**

Playing with food

This is coded as the **total number of times** the child "plays" with food but not placing the food in their mouth. Playing with food is defined as messing, stirring, throwing and crumbling the food or treating the food as well as the utensils as a toy without consuming the food. Note if the child consumes the food immediately after playing, then this **is not** coded as playing but as consumption of food. Playing is only coded when the child plays with the food and/ or the utensils without consuming the food. **A count was made each time the child played with food.**

Spitting of food

This is coded as the **total number of times** the child places the food in their mouth and spits it out or vomits. **A count was made each time the child spat out food.**

Rejection of food

This is coded as the **total number of times** the child refuses the present food by pushing the food away, turning the head away when presented by the parent or by verbal refusal to try the food. **A count was made each time the child displayed food rejection behaviours**

Child Negative comments

This is coded as the **total number** of negative sounds and comments the child expresses towards the presented food. This includes complaints and expressions of disgust, e.g. “this taste disgusting”, “Yuk!” **A count was made each time the child uttered a negative food comment or sound.**

Child Positive comments

This is coded as the **total number** of positive sounds and comments the child expresses towards the presented food, e.g. “I like this”, “this taste nice”, and “yum!” **A count was made each time uttered a positive food comment or sound.**

Maternal negative comments

This is coded as the **total number** of negative sounds and comments the mother makes about the presented food. **A count was made each time the mother made a negative food comment or sound.**

Maternal Positive comments

This is coded as the **total number** of positive sounds and comments the mother makes about the presented food. **A count was made each time the mother made a positive food comment or sound.**

Proportion of familiar and appealing food eaten.

This is the amount of familiar and appealing food the child has consumed relative to the total amount of familiar and appealing food presented.

Proportion of familiar and unappealing food eaten.

This is the amount of familiar and unappealing food the child has consumed relative to the total amount of familiar and unappealing food presented.

Proportion of unfamiliar and appealing food eaten.

This is the amount of unfamiliar and appealing food the child has consumed relative to the total amount of unfamiliar and appealing food presented.

Proportion of unfamiliar and unappealing food eaten.

This is the amount of unfamiliar and unappealing food the child has consumed relative to the total amount of unfamiliar and unappealing food presented.

Appendix S: Operational Definitions for the items coded from the FMCS – Study 3

Feeding Practice	Definition	Measurement
Use of Pressure	These are verbal encouragements from the parent to the child to persuade him/her to consume more food and includes vocalisations such as "try some more of the soup" or "have some more broccoli".	This is coded as the **total number of times** the mother uses verbal encouragements to get the child to consume the presented food. **A count was made each time the mother used verbal pressure**
Use of Physical Prompts	These are the parent's use of physical movements to encourage the child to consume more food including strategies such as pushing a plate of food towards the child, placing the food on a fork/spoon ready for the child to pick up and eat or feeding the child.	This is coded as the **total number of times** the mother uses physical encouragements to get the child to consume the presented food usually by offering the food to the child. **A count was made each time the mother used physical prompts**
Use of food rewards	These involve mother's use of food rewards to encourage food consumption by the child. This may include promising the child a favourite food for trying the presented food	This is coded as the **total number of times** the mother uses food rewards with the child to encourage food consumption. **A count was made each time the**

		mother used a food reward.
Use of non-food rewards	These involve mother's use of non-food rewards to encourage food consumption by the child. This may include promising the child a favourite toy, stickers, visiting a favourite place or the chance to play a favourite game in return for trying the presented food.	This is coded as the **total number of times** the mother uses non- food rewards with the child to encourage food consumption. **A count was made each time the mother used a non-food reward.**

Appendix T: Sensory Assessment for Neurodevelopmental Disorders (Siper et al., 2017)

SAND OBSERVATION & INTERVIEW ALGORITHM			
VISUAL (V)		**OBSERVED**	**REPORTED**
Hyperreactivity (V1)			
V1.1	Squints, covers, or closes eyes in response to *bright* or *flickering* visual stimuli		
V1.2	Squints, covers, or closes eyes in response to *moving* visual stimuli		
V1.3	Bothered by visual stimuli (pushes away or turns away from objects)		
Specifier(s):	*Visual Hyperreactivity Severity*		
Hyporeactivity (V2)			
V2.1	Slow to respond or unresponsive to direct presentation of *bright* or *flickering* lights		
V2.2	Slow to respond or unresponsive to *moving* objects		
V2.3	Does not notice presentation of visual stimuli without prompting		
Specifier(s):	*Visual Hyporeactivity Severity*		
Unusual Sensory Interests (V3)			
V3.1	Fixates on visual stimuli (intense peering, visual inspection)		
V3.2	Moves or flicks fingers or objects in peripheral visual fields		
V3.3	Seeks out bright, colored, or shiny objects/lights		
Specifier(s):	*Visual Sensory Seeking Severity*		
TACTILE (T)			
Sensory Hyperreactivity (T1)			
T1.1	Bothered by certain textures		
T1.2	Heightened reaction to hot or cold temperatures		
T1.3	Resists touch by people or objects		
Specifier(s):	*Tactile Hyperreactivity Severity*		
Sensory Hyporeactivity (T2)			
T2.1	Does not notice when touched		
T2.2	Minimal or no reaction to hot or cold temperatures or pain (high threshold)		
T2.3	Decreased awareness of texture		
Specifier(s):	*Tactile Hyporeactivity Severity*		
Unusual Sensory Interests (T3)			
T3.1	Fascination with certain textures		
T3.2	Enjoys seeking pressure, bumps or crushes into things		
T3.3	Seeks opportunity to feel textures repeatedly or for extended periods		
Specifier(s):	*Tactile Sensory Seeking Severity*		

AUDITORY (A)			
Sensory Hyperreactivity (A1)			
A1.1	Startles in response to sounds		
A1.2	Tries to stop objects making sounds		
A1.3	Holds hands over ears or puts fingers in ears		
Specifier(s):	*Auditory Hyperreactivity Severity*		
Sensory Hyporeactivity (A2)			
A2.1	Slow to respond or unaware of everyday sounds (e.g., phone ringing)		
A2.2	Slow to respond or unaware of noxious noises (e.g., sirens)		
A2.3	Minimally responsive to loud unexpected noises (e.g., doorbell; dropped item)		
Specifier(s):	*Auditory Hyporeactivity Severity*		
Unusual Sensory Interests (A3)			
A3.1	Repeatedlty seeks out/fascinated by sounds		
A3.2	Atypical use of objects or voice to create sounds		
A3.3	Puts ear close to noisemaking objects		
Specifier(s):	*Auditory Sensory Seeking Severity*		

Olfactory (O)		OBSERVED	REPORTED
Hyperreactivity (O1)			
O1.1	Turns away from ordinary smells		
O1.2	Holds his/her nose in response to a smell		
V1.3	Pushes objects that smell away		
Specifier(s):	*gustatory Hyperreactivity Severity*		
Hyporeactivity (O2)			
O2.1	Slow to respond or unresponsive to direct presentation of ordinary smell (lemon, perfume)		
O2.2	Slow to respond or unresponsive to unpleasant smell (onion)		
O2.3	Does not notice different smells without prompting		
Specifier(s):	*gustatory Hyporeactivity Severity*		
Unusual Sensory Interests (O3)			
O3.1	Repetedly smells objects and brings them to nose		
O3.2	Always smells food		
O 3.3	Seeks out strong smells		
Specifier(s):	*gustatory Sensory Seeking Severity*		

Taste (Ta)		OBSERVED	REPORTED
HyperreactiTaity (Ta1)			
Ta1.1	Refuses to try child friendly tastes (e.g. pretzel, yogught)		
Ta1.2	Gaggs in response to ordinary food		
Ta1.3	Spits out food		
Specifier(s):	*gustatory Hyperreactivity Severity*		
Hyporeactivity (Ta2)			
Ta2.1	Slow to respond or unresponsive to strong tastes (e.g. lemon)		
Ta2.2	Slow to respond or unresponsive to food tastes (e.g. pretzel)		
Ta2.3	Does not notice different tastes (e.g. sweet versus salty)		
Specifier(s):	*gustatory Hyporeactivity Severity*		
Unusual Sensory Interests (Ta3)			
Ta3.1	Seeks out certain tastes, e.g. sweet or salty		
Ta3.2	Enjoys eating dtrong tastes, e.g. spicey, salty		
Ta 3.3	Is fascinated by tastes and tries everything repeateldy		
Specifier(s):	*gustatory Sensory Seeking Severity*		

APPENDIX U: SHORT SENSORY PROFILE (SSP; Dunn, 1999)

Short Sensory Profile

SENSORY PROFILE

Winnie Dunn, Ph.D., OTR, FAOTA

Child's Name: ______________________ Birth Date: __________ Date: __________

Completed by: ______________________ Relationship to Child: __________

Service Provider's Name: ______________________ Discipline: __________

INSTRUCTIONS

Please check the box that **best** describes the frequency with which your child does the following behaviors. Please answer all of the statements. If you are unable to comment because you have not observed the behavior or believe that it does not apply to your child, please draw an X through the number for that item. Please do not write in the Section Raw Score Total row.

Use the following key to mark your responses:

- **ALWAYS** When presented with the opportunity, your child always responds in this manner, 100% of the time.
- **FREQUENTLY** When presented with the opportunity, your child frequently responds in this manner, about 75% of the time.
- **OCCASIONALLY** When presented with the opportunity, your child occasionally responds in this manner, about 50% of the time.
- **SELDOM** When presented with the opportunity, your child seldom responds in this manner, about 25% of the time.
- **NEVER** When presented with the opportunity, your child never responds in this manner, 0% of the time.

Item	Tactile Sensitivity	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
1	Expresses distress during grooming (for example, fights or cries during haircutting, face washing, fingernail cutting)					
2	Prefers long-sleeved clothing when it is warm or short sleeves when it is cold					
3	Avoids going barefoot, especially in sand or grass					
4	Reacts emotionally or aggressively to touch					
5	Withdraws from splashing water					
6	Has difficulty standing in line or close to other people					
7	Rubs or scratches out a spot that has been touched					
	Section Raw Score Total					
Item	**Taste/Smell Sensitivity**					
8	Avoids certain tastes or food smells that are typically part of children's diets					
9	Will only eat certain tastes (list: ______________________)					
10	Limits self to particular food textures/temperatures (list: ______________________)					
11	Picky eater, especially regarding food textures					
	Section Raw Score Total					
Item	**Movement Sensitivity**					
12	Becomes anxious or distressed when feet leave the ground					
13	Fears falling or heights					
14	Dislikes activities where head is upside down (for example, somersaults, roughhousing)					
	Section Raw Score Total					
Item	**Underresponsive/Seeks Sensation**					
15	Enjoys strange noises/seeks to make noise for noise's sake					
16	Seeks all kinds of movement and this interferes with daily routines (for example, can't sit still, fidgets)					
17	Becomes overly excitable during movement activity					
18	Touches people and objects					
19	Doesn't seem to notice when face or hands are messy					
20	Jumps from one activity to another so that it interferes with play					
21	Leaves clothing twisted on body					
	Section Raw Score Total					

0761638199

Item	Auditory Filtering	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
22	Is distracted or has trouble functioning if there is a lot of noise around					
23	Appears to not hear what you say (for example, does not "tune-in" to what you say, appears to ignore you)					
24	Can't work with background noise (for example, fan, refrigerator)					
25	Has trouble completing tasks when the radio is on					
26	Doesn't respond when name is called but you know the child's hearing is OK					
27	Has difficulty paying attention					
	Section Raw Score Total					

Item	Low Energy/Weak	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
28	Seems to have weak muscles					
29	Tires easily, especially when standing or holding particular body position					
30	Has a weak grasp					
31	Can't lift heavy objects (for example, weak in comparison to same age children)					
32	Props to support self (even during activity)					
33	Poor endurance/tires easily					
	Section Raw Score Total					

Item	Visual/Auditory Sensitivity	ALWAYS	FREQUENTLY	OCCASIONALLY	SELDOM	NEVER
34	Responds negatively to unexpected or loud noises (for example, cries or hides at noise from vacuum cleaner, dog barking, hair dryer)					
35	Holds hands over ears to protect ears from sound					
36	Is bothered by bright lights after others have adapted to the light					
37	Watches everyone when they move around the room					
38	Covers eyes or squints to protect eyes from light					
	Section Raw Score Total					

FOR OFFICE USE ONLY

Summary

Instructions: Transfer the score for each section to the Section Raw Score Total column. Plot these totals by marking an X in the appropriate classification column (Typical Performance, Probable Difference, Definite Difference).*

SCORE KEY

1 = Always
2 = Frequently
3 = Occasionally
4 = Seldom
5 = Never

Section	Section Raw Score Total	Typical Performance	Probable Difference	Definite Difference
Tactile Sensitivity	/35	35 —— 30	29 —— 27	26 —— 7
Taste/Smell Sensitivity	/20	20 —— 15	14 —— 12	11 —— 4
Movement Sensitivity	/15	15 —— 13	12 —— 11	10 —— 3
Underresponsive/Seeks Sensation	/35	35 —— 27	26 —— 24	23 —— 7
Auditory Filtering	/30	30 —— 23	22 —— 20	19 —— 6
Low Energy/Weak	/30	30 —— 26	25 —— 24	23 —— 6
Visual/Auditory Sensitivity	/25	25 —— 19	18 —— 16	15 —— 5
Total	/190	190 —— 155	154 —— 142	141 —— 38

*Classifications are based on the performance of children without disabilities ($n = 1{,}037$).

THE PSYCHOLOGICAL CORPORATION®
A Harcourt Assessment Company

Printed in the United States of America.
12 A B C D E
0761638199

Appendix V: Sensory Processing Three Dimensions (Schoen et al., 2008)

Date ____________________
Pre Treatment ____________
Post Treatment ___________

Name ____________________

Approved
FEB 05 2010
COMIRB

Checklist #1 [check each description that applies to your child]

These garments bother my child

1 [ ] seams in clothing
2 [ ] tags in clothing
3 [ ] socks
4 [ ] changing from long to short pants
5 [ ] accessories (e.g., watch, jewelry, scarf, hats)
6 [ ] elastic on clothing
7 [ ] fuzzy or furry textured clothes (e.g., sweaters, collars, etc.)
8 [ ] wool clothes

These aspects of self care bother my child

9 [ ] washing or wiping face
10 [ ] cutting toenails or fingernails
11 [ ] having haircut or hair clipped
12 [ ] hair washing or drying
13 [ ] hair brushing or combing
14 [ ] getting dressed
15 [ ] brushing teeth
16 [ ] getting dirty
17 [ ] having crumbs around my mouth
18 [ ] having messy hands
19 [ ] having a messy mouth

[ ] **Subtotal**

These tactile sensations bother my child

20 [ ] mud
21 [ ] finger paint
22 [ ] glue
23 [ ] play dough
24 [ ] foods
25 [ ] hair care products (greasy/sticky)
26 [ ] kissing
27 [ ] coarse carpet
28 [ ] light stroking touch

[ ] **Subtotal**

These visual sensations bother my child

29 [ ] brightly colored or patterned materials (e.g. clothes, upholstery, drapes, wallpaper)
30 [ ] fluorescent lights
31 [ ] fast moving images in the movies or TV
32 [ ] visually cluttered environments
33 [ ] busy pictures in books or complex and busy images in artwork

[ ] **Subtotal**

Protocol number: 03-339, 04-0954, 99-932
Revision date: 12.1.2009
PI: L.J. Miller

Appendix W: Information Sheet- Study 4

The ‘Sensory Perception project’

Information sheet for caregivers

Dear < >

You and your child are invited to take part in the ‘Sensory Perception’ project at the University of Reading. We would be grateful if you consider taking part in our research.

The purpose of this study is to investigate sensory perception in children with and without neurodevelopmental disorders such as autism spectrum disorders (ASD). Your child may qualify to take part in this research study because he/she will act as a comparison meaning he/she does not have ASD and is between the ages of 1 and 12. OR your child might qualify because he/she has a diagnosis of ASD and is between the ages of 1 and 12. We aim to find out more about the precise nature of sensory perception and its underlying mechanisms.

You and your child will be invited to the University of Reading for one visit. After you sign the consent form, your child will be enrolled in the study. You will be asked to fill out questionnaires about your child’s temperament, eating behaviour and responses towards sensory stimuli, such as sounds. In total they should take no more than 45 minutes to complete. Following diagnostic and cognitive testing, your child will undergo testing of his/her abilities to perceive sensory such as light, sounds, touch, smells and tastes. All tasks will be presented as games. We might measure your child’s physiological arousal, more narrowly his/her skin conductance and heart rate. This would mean applying biosensors around your child’s fingertips or a wrist. The researcher will observe your child’s behaviour and we need to videotape these tasks for scoring or research purposes. The tasks should take no longer than 45 minutes to complete.

Participation in this study is completely voluntary and you can choose to withdraw your participation at any time without giving any reason and without any penalty.

All the information we collect and that you share with us will be kept confidential. We will use a unique code known only to the project team to identify any information relating to the child in question. That way, all of the information is anonymous. Electronic data will be stored on secure servers and password protected. Only the researchers working on this project will have access to this data. De-identified electronic data for the whole group will be deposited to the UK Data Service; no personal or identifiable information will be included. This study has been reviewed by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct. All investigators on the project have had criminal records checks and have been approved by the School to work with children.

Many thanks for your time and assistance with our project.

Contact: Dr Teresa Tavassoli

t.tavassoli@reading.ac.uk; phone: 0118378 8100

Appendix X: Consent form- Study 4

Consent form

Sensory Perception Project

I, ……………………………………………………agree that my child is taking part in the study on Sensory Perception, being conducted by Dr Teresa Tavassoli at The University of Reading. I have seen and read a copy of the Information Sheet and have been given the opportunity to ask questions about the study and these have been answered to my satisfaction. I understand that all personal information will remain confidential to the project team and arrangements for the storage of any identifiable material have been made clear to me. I understand that participation in this study is voluntary and that I can withdraw at any time without having to give an explanation and without penalty.

This application has been reviewed by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct

I am happy to proceed with my participation and my child's participation. YES NO

I am happy for video recordings to be made for scoring behaviours later on YES NO

I am happy for my child's data to be entered into a research database, which Will only be accessed by members of the research team YES NO

Someone may contact me in the future to take part in more research YES NO

Preferred contact method: ☐Telephone:______________________________

☐Mail: ____________________________________

☐E-mail Address: __________________________

Name --

Appendix Y: Invitation Email – Study 4

Dear < >

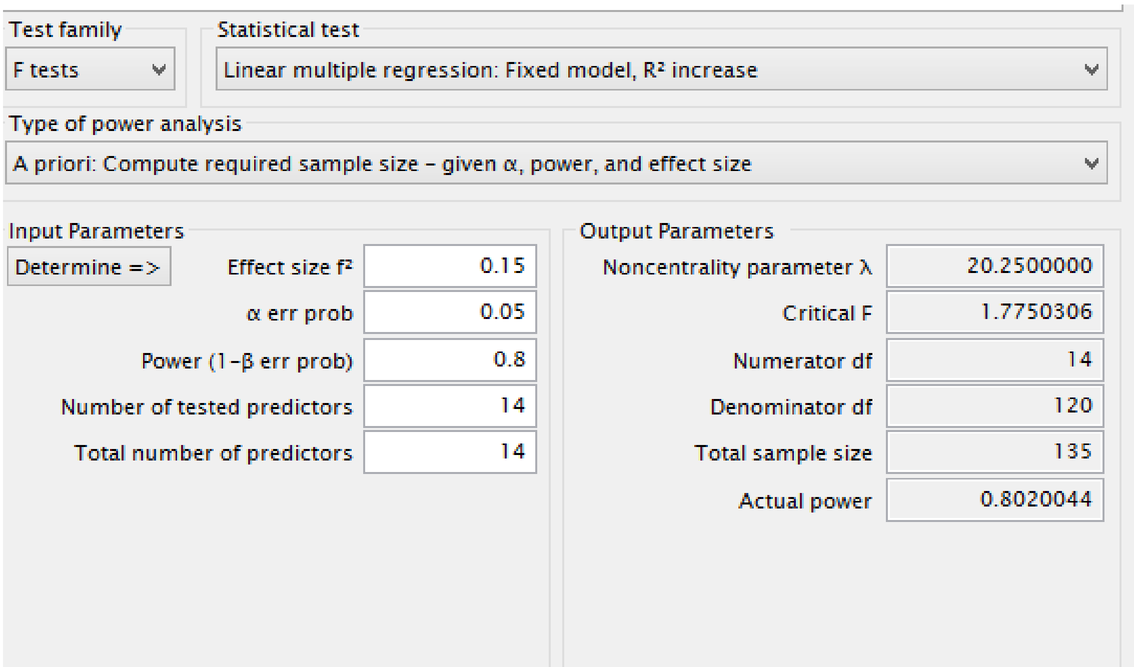
Previously you showed interest in taking part in research conducted at the University of Reading. Thus, you and your child are invited to take part in the ‘Sensory Perception’ project at the University of Reading. We would be grateful if you consider taking part in our research. Please find the information sheet attached. Please let us know if you have any further question and/or if you would like to take part in our research. Your help is highly appreciated!

Warm regards,

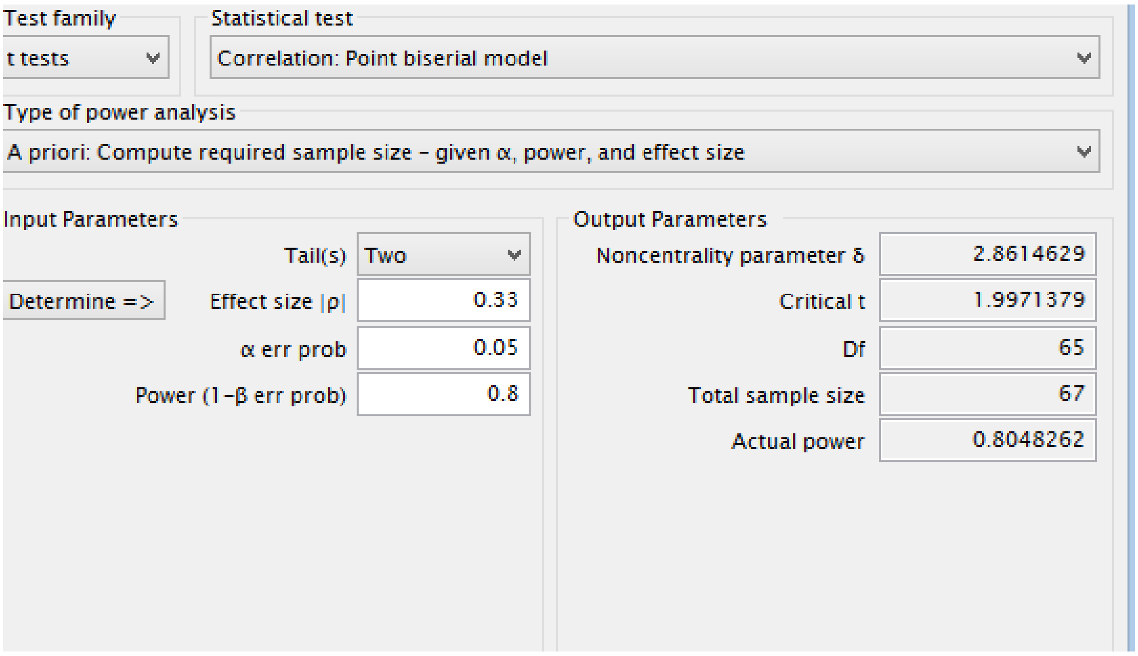
Teresa Tavassoli, PhD

Appendix Z: Power analysis using G*Power 3 (Faul et al., 2007)

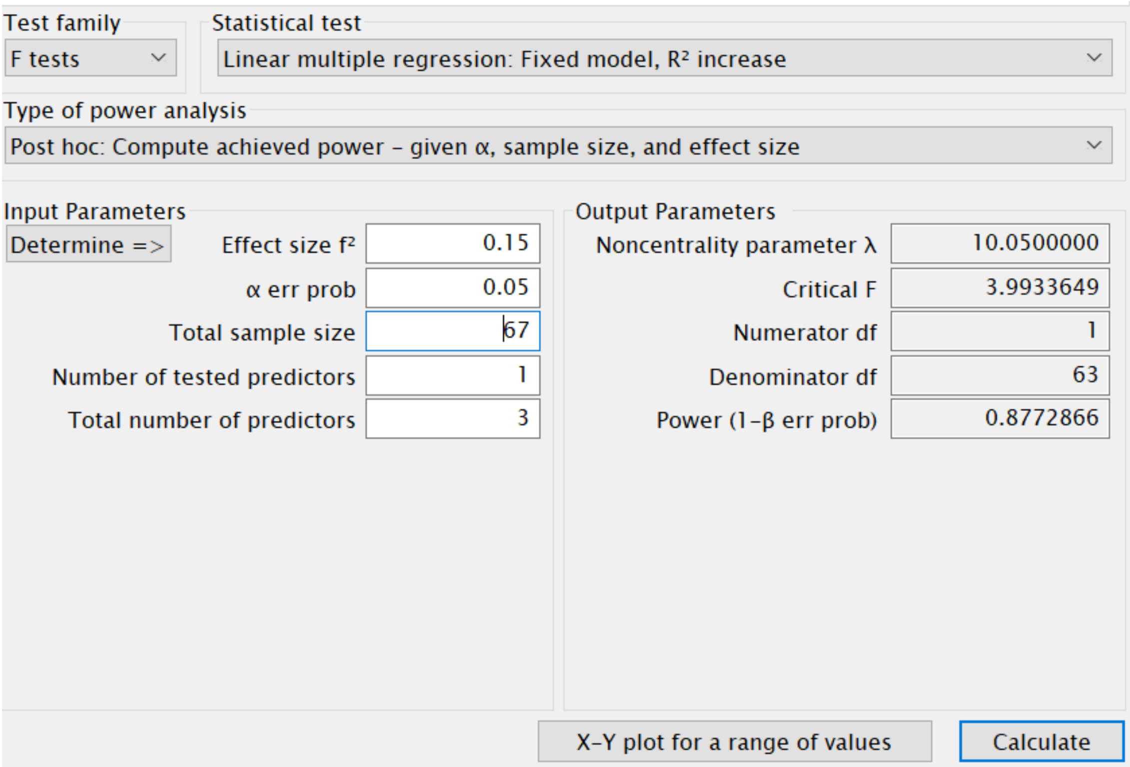
Study 1



Study 2



Study 3



Study 4